PB90-126475

Preliminary Data Summary for the Paint Formulating Point Source Category

(U.S.) Environmental Protection Agency, Washington, DC

Sep 89

U.S. Department of Commerce
National Technical Information Service
NTIS

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. 440/1-89/050	2.	3. Recipient's Accession No. PB90-126475

4. Title and Subtitle
Preliminary Data Summary for the Paint Formulating Point Source Category

5. Report Date

6.

7. Author(s)
Dick Williams

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
Environmental Protection Agency
WH-552
401 M Street, S.W.
Washington, D.C. 20460

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address

13. Type of Report & Period Covered

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

This document is one of a series of Preliminary Data Summaries prepared by the Office of Water Regulations and Standards of the U. S. Environmental Protection Agency. The Summaries contain engineering, economic and environmental data that pertain to whether industrial facilities in various industries discharge pollutants in their wastewaters and whether the EPA should pursue regulations to control such discharges. The summaries were prepared in order to allow EPA to respond to the mandate of Section 304(m) of the Clean Water Act, which requires the Agency to develop plans to regulate industrial categories that contribute to pollution of the Nation's surface waters. Summaries for categories already subject to rulemaking were developed for comparison purposes, and contain only the minimum amount of data needed to provide some perspective on the relative magnitude of the pollution problems created across the categories.

cont on pg.

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Unlimited	Unclassified	100
	20. Security Class (This Page) Unclassified	22. Price

(See ANSI-Z39.18) See Instructions on Reverse

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

United States
Environmental Protection
Agency

Office of Water Regulations
and Standards

EPA 440/1-89/050
September 1989

Water

PB90-126475

EPA

Preliminary Data Summary for the Paint Formulating Point Source Category

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22161

PRELIMINARY DATA SUMMARY
FOR THE
PAINT FORMULATING
POINT SOURCE CATEGORY

Office of Water Regulations and Standards
Office of Water
United States Environmental Protection Agency
Washington, D.C.

August 1989

PREFACE

This is one of a series of Preliminary Data Summaries prepared by the Office of Water Regulations and Standards of the U.S. Environmental Protection Agency. The Summaries contain engineering, economic and environmental data that pertain to question as to whether the industrial facilities in various industries discharge pollutants in their wastewaters and whether the EPA should pursue regulations to control such discharges. The summaries were prepared in order to allow EPA to respond to the mandate of section 304(m) of the Clean Water Act, which requires the Agency to develop plans to regulate industrial categories that contribute to pollution of the Nation's surface waters.

The Summaries vary in terms of the amount and nature of the data presented. This variation reflects several factors, including the overall size of the category (number of dischargers), the amount of sampling and analytical work performed by EPA in developing the Summary, the amount of relevant secondary data that exists for the various categories, whether the industry had been the subject of previous studies (by EPA or other parties), and whether or not the Agency was already committed to a regulation for the industry. With respect to the last factor, the pattern is for categories that are already the subject of regulatory activity (e.g., Pesticides, Pulp and Paper) to have relatively short Summaries. This is because the Summaries are intended primarily to assist EPA management in designating industry categories for rulemaking. Summaries for categories already subject to rulemaking were developed for comparison purposes, and contain only the minimal amount of data needed to provide some perspective on the relative magnitude of the pollution problems created across the categories.

ACKNOWLEDGEMENTS

Preparation of this Preliminary Data Summary was directed by Mr. Richard Williams of the Industrial Technology Division. Preparation of the economic analysis sections was directed by Mr. Mitchell Dubensky of the Analysis and Evaluation Division. Ms. Allison Greene of the Assessment and Watershed Protection Division was responsible for preparation of the environmental assessment analysis. Support was provided under EPA Contract Nos. 68-03-3412, 68-03-3548 and 68-03-3339.

Additional copies of this document may be obtained by writing to the following address:

Industrial Technology Division (WH-552)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Telephone (202) 382-7131

TABLE OF CONTENTS

Section	Title	Page No.
	EXECUTIVE SUMMARY	i
1.0	INTRODUCTION	1
1.1	Purpose and Authority	1
1.2	Legislative History	1
1.3	Regulatory Background	3
TECHNICAL SUPPORT STUDY		
2.0	INTRODUCTION TO TECHNICAL SUPPORT STUDY	7
2.1	Introduction	7
2.2	Study Methodologies	7
3.0	DESCRIPTION OF THE INDUSTRY	9
3.1	Industry Profile	9
3.2	Industry Processes	11
3.2.1	Solvent-base Paint Formulation	11
3.2.2	Water-base Paint Formulation	13
4.0	INDUSTRY SUBCATEGORIZATION	16
5.0	WATER USE AND WASTE CHARACTERISTICS	17
5.1	Wastewater Sources	17
5.1.1	Solvent-base Paint Formulation	17
5.1.2	Water-base Paint Formulation	17
5.1.3	Caustic Cleaning Operations	18
5.2	Wastewater Volume	19
5.3	Wastewater Characterization	21
5.3.1	Background	21
5.3.2	Sampling and Analytical Results	22
6.0	POLLUTANT PARAMETERS	44
6.1	Introduction	44
6.2	Pollutant Categories	45
6.2.1	Organic Pollutants	45
6.2.2	Metals	45
6.2.3	Pesticides/Herbicides	45
6.2.4	Conventional Pollutants	51
6.2.5	Non-conventional Pollutants	51
6.2.6	Sludge - Pollutant Parameters	51

TABLE OF CONTENTS
(continued)

Section	Title	Page No.
7.0	CONTROL AND TREATMENT TECHNOLOGY	56
7.1	In-plant Source Control Strategies	56
7.1.1	Wastewater Reduction	56
7.1.2	Wastewater Reuse	59
7.2	Water Wash Wastestream Treatment and Disposal Practices	59
7.3	Solvent Wash Wastestream Treatment and Disposal Practices	60
	ECONOMIC IMPACT ANALYSIS	
8.0	INTRODUCTION TO THE ECONOMIC IMPACT STUDY	62
8.1	Introduction	62
8.2	Industry Profile	62
8.3	Number and Location of Facilities	64
8.4	Employment Characteristics	64
8.5	Ownership Characteristics	69
8.6	Products and Prices	70
8.7	Financial Characteristics	71
8.8	Foreign Trade	73
8.9	Trends in the Industry	73
9.0	ECONOMIC IMPACT ASSESSMENT	74
9.1	Methodology	74
9.2	Definition of Typical Plants	75
9.3	Economic Impacts	78
10.0	LIMITS OF THE ANALYSIS	85
10.1	Definition of Industry	85
10.2	Economic/Financial Data	85
10.3	Regulatory Options and Compliance Costs	85
	ENVIRONMENTAL IMPACT ANALYSIS	
11.0	ENVIRONMENTAL IMPACT ANALYSIS	88
11.1	Summary of the Environmental Impact Study	88
11.2	Methodology	91
11.3	Impacts on Human Health	91
11.4	Impacts on Aquatic Life	91
11.5	POTW Impacts	92

TABLE OF CONTENTS
(continued)

Section	Title	Page No.
11.6	Receiving Stream Profiles	92
11.7	Pollutant Fate	92
12.0	REFERENCES	94

APPENDICES

APPENDIX A DATA SUMMARIES FROM PREVIOUS STUDIES

APPENDIX B LIST OF PRIORITY POLLUTANTS ANALYZED IN WASTEWATER OF PAINT PLANTS A, B, C, and D

APPENDIX C LIST OF NON-PRIORITY POLLUTANTS ANALYZED IN WASTEWATER OF PAINT PLANTS A, B, C, AND D

APPENDIX D POTW MODEL RESULTS USING 50TH PERCENTILE POTW AND RECEIVING STREAM FLOWS

APPENDIX E POTW MODEL RESULTS USING 25TH PERCENTILE POTW AND RECEIVING STREAM FLOWS

APPENDIX F DILUTION FACTOR RESULTS-INDIRECTS

LIST OF TABLES

Table	Title	Page No.
3-1	1985 PAINT PRODUCTS BY TYPE AND END USE DISTRIBUTION	10
5-1	AMOUNT OF WATER USED TO CLEAN A PAINT TANK	20
5-2	SUMMARY OF REPORTED ANALYTICAL RESULTS, PAINT PLANT A.	25
5-3	SUMMARY OF REPORTED ANALYTICAL RESULTS, PAINT PLANT B.	32
5-4	SUMMARY OF REPORTED ANALYTICAL RESULTS, PAINT PLANT C.	35
5-5	SUMMARY OF REPORTED ANALYTICAL RESULTS, PAINT PLANT D.	40
6-1	DATA SUMMARY 1986/1987 SAMPLING PROGRAM, PRIORITY POLLUTANTS	46
6-2	DATA SUMMARY 1986/1987 SAMPLING PROGRAM, NON-PRIORITY POLLUTANTS	48
6-3	SUMMARY OF REPORTED ANALYTICAL RESULTS FOR WASTEWATER SLUDGE SAMPLES	52
7-1	SUMMARY OF MUNICIPAL TREATMENT SYSTEM INFLUENT LIMITATIONS.	57
8-1	LOCATION OF PAINT FORMULATING PLANTS	65
8-2	SIZE OF THE PAINT FORMULATING INDUSTRY	67
8-3	DISTRIBUTION OF PLANTS BY NUMBER OF EMPLOYEES.	68
8-4	HISTORIC PROFITABILITY LEVELS.	72
9-1	TYPICAL PAINT FORMULATING PLANT.	76
9-2	FINANCIAL PROFILES - TYPICAL PAINT PLANTS.	77
9-3	IMPACT ON TYPICAL PLANT PROFITS VARIOUS ANNUAL COMPLIANCE COSTS	79
9-4	ESTIMATE 1986 COMPLIANCE COSTS	84
11-1	PROFILE OF PAINT FORMULATING INDUSTRY USED IN THE ENVIRONMENTAL IMPACT ANALYSIS.	89
11-2	SUMMARY OF WATER QUALITY CRITERIA EXCEEDANCES RCRA/ITD SAMPLING DATA.	90
11-3	ENVIRONMENTAL FATE OF POLLUTANTS OF CONCERN.	93

LIST OF TABLES
IN APPENDICES

Table	Title
	APPENDIX A
A-1	DATA SUMMARY 1985 DSS SAMPLING PROGRAM - RAW WASTEWATER AND TREATED WASTEWATER SAMPLES FROM A PAINT FORMULATING FACILITY
A-2	AVERAGE UNTREATED WASTEWATER CONCENTRATIONS - 1975 PAINT SAMPLING PROGRAM - SAMPLING OF NINE PAINT FORMULATIVE FACILITIES
A-3	AVERAGE TREATED OF WASTEWATER CONCENTRATIONS 1976 PAINT SAMPLING PROGRAM SAMPLING OF NINE PAINT FORMULATING FACILITIES
A-4	RAW WASTEWATER DATA SUMMARY 1977/1978 SAMPLING PROGRAM PRIORITY POLLUTANTS, CONVENTIONALS, NON-CONVENTIONALS
A-5	TREATED WASTEWATER DATA SUMMARY 1977/1978 SAMPLING PROGRAM PRIORITY POLLUTANTS, CONVENTIONAL, AND NON-CONVENTIONALS
A-6	SLUDGE DATA SUMMARY - 1977/1978 SAMPLING PROGRAM PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS
A-7	INTAKE (TAP) WATER DATA SUMMARY 1977/1978 SAMPLING PROGRAM PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS
	APPENDIX B
B-1	LIST OF PRIORITY POLLUTANTS ANALYZED IN WASTEWATER OF PAINT PLANTS A, B, C, AND D
	APPENDIX C
C-1	LIST OF NON-PRIORITY POLLUTANT PARAMETERS ANALYZED IN WASTEWATER OF PLANTS A, B, C, AND D
	APPENDIX D
	50th Percentile
D-1	ENVIRONMENTAL ANALYSIS FOR THE PAINT FORMULATING INDUSTRY INDIRECT DISCHARGERS - PLANT A
D-2	ENVIRONMENTAL ANALYSIS FOR THE PAINT FORMULATING INDUSTRY INDIRECT DISCHARGERS - PLANT B

LIST OF TABLES
IN APPENDICES
(continued)

Table	Title
D-3	ENVIRONMENTAL ANALYSIS FOR THE PAINT FORMULATING INDUSTRY INDIRECT DISCHARGES - PLANT D
D-4	ENVIRONMENTAL ANALYSIS FOR THE PAINT FORMULATING INDUSTRY INDIRECT DISCHARGERS - PLANT E

APPENDIX E

25th Percentile

E-1 ENVIRONMENTAL ANALYSIS FOR THE PAINT FORMULATING INDUSTRY INDIRECT DISCHARGERS - PLANT A

E-2 ENVIRONMENTAL ANALYSIS FOR THE PAINT FORMULATING INDUSTRY INDIRECT DISCHARGERS - PLANT B

E-3 ENVIRONMENTAL ANALYSIS FOR THE PAINT FORMULATING INDUSTRY INDIRECT DISCHARGERS - PLANT D

E-4 ENVIRONMENTAL ANALYSIS FOR THE PAINT FORMULATING INDUSTRY INDIRECT DISCHARGERS - PLANT E

APPENDIX F

F-1 SUMMARY OF INDIRECT DISCHARGERS

F-2 INDIRECT DISCHARGE DILUTION FACTOR

F-3 DISTRIBUTION FREQUENCIES (MGD) - INDIRECT DISCHARGERS

LIST OF FIGURES

Figure	Title	Page No.
3-1	GENERAL FLOW DIAGRAM OF FORMULATION PROCESS FOR SOLVENT-BASE PAINTS.	12
3-2	GENERAL FLOW DIAGRAM OF FORMULATION PROCESS FOR WATER-BASE PAINTS.	14
5-1	WASTEWATER TREATMENT SYSTEM, PAINT PLANT A	24
5-2	WASTEWATER TREATMENT SYSTEM, PAINT PLANT B	31
5-3	SOLVENT PURIFICATION, PAINT PLANT C.	37
5-4	SAMPLE POINT SCHEMATIC, PAINT PLANT D.	39
9-1	IMPACT ON PROFITS OF SMALL-SIZE PLANTS	80
9-2	IMPACT ON PROFITS OF MEDIUM-SIZE PLANTS.	81
9-3	IMPACT ON PROFITS OF LARGE-SIZE PLANTS	82

EXECUTIVE SUMMARY

The Hazardous and Solid Waste Amendments of 1984 (HSWA) to the Resource Conservation and Recovery Act (RCRA) required EPA to submit a report to Congress concerning those substances identified or listed under Section 3001 of HSWA which are not regulated under this subtitle by reason of the exclusion for mixtures of domestic sewage and other wastes that pass through a sewer system to a publicly owned treatment works (POTW).

The "Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works," EPA/530-SW-86-004, February 1986 (the Domestic Sewage Study, or DSS) examined the nature and sources of hazardous wastes discharged to POTWs, evaluated the effectiveness of Agency programs in dealing with such discharges, and presented recommendations for improving controls on hazardous waste discharges to POTWs. The paint formulating industry is one of 12 industries identified in the DSS as a potential source of hazardous waste discharges to POTWs. The paint formulating industry had been previously excluded from coverage under the Clean Water Act under the authority of Paragraph 8 of the EPA/Natural Resources Defense Council (NRDC) Consent Decree.

The DSS recommended that additional research, data collection, and analysis be conducted to fill paint formulating industry information gaps concerning the sources and quantities of hazardous waste constituents and their effects on POTWs and the environment.

The purpose of this study was to gather information to assist the Agency in deciding whether to develop national effluent limitations guidelines and standards for the industry. The document comprises three studies, undertaken independently, listed as follows:

- a technical support study
- an economic impact study
- an environmental impact study.

The technical support study consisted of two parts: the collection and analysis of paint formulating wastewater and waste solids samples, and the collection of sufficient information about the industry to develop a preliminary updated industry technical profile. The economic impact study consisted of a review and update of the economic profile of the paint formulating industry and an analysis of the projected economic impact of wastewater regulation on the industry. The environmental impact study involved an evaluation of the impacts of paint formulating wastewater discharges to publicly owned treatment works (POTWs) and their receiving streams.

In the technical support study, samples of raw wastewater, treated final effluent, and waste solid samples were collected and analyzed for toxic, conventional, and non-conventional pollutants at four facilities. The nonconventional pollutants included approximately
250 organic and inorganic substances on the Industrial Technology Division (ITD) List of Analytes. In addition, plant visits were conducted at ten paint formulating facilities (including the sampled facilities) during which information on paint formulation practices and waste treatment and handling was obtained.

Twenty organic compounds were detected in the raw wastewater samples. The highest value detected was for acetone, found at more than 1,000 mg/l. Three pesticide/herbicide compounds: aldrin, chlordane, and phosmet, were detected at low concentrations. Twenty-five metals were detected in the raw wastewater samples. The highest concentrations found were aluminum, calcium, iron, magnesium, sodium, and zinc.

Economic data characterizing the paint formulating industry were obtained from the U.S Census Bureau, the National Paint and Coatings Association (NPCA) and earlier USEPA Effluent Guidelines studies. The significant findings from the economic study were as follows:

- the industry is comprised of many rather small firms (less than 20 employees) that own a single plant and a few large ones which economically dominate the industry
- the paint formulating industry is a mature industry and its growth is dependent on the level of construction activity and the general business climate
- many small plants would have difficulty absorbing additional compliance costs while medium and large plants would not have difficulty.

The environmental impact study evaluated the water quality impacts of discharges from four indirect paint plants on publicly owned treatment works and ultimately on the POTWs' receiving streams. Impacts on the POTWs were evaluated in terms of inhibition of POTW operations and contamination of the POTW sludge. Receiving stream impacts were evaluated by comparing estimated instream pollutant concentrations with aquatic life toxic effects levels and EPA Water Quality Criteria developed for human health and aquatic life protection.

The potential water quality impacts were projected to be minimal. Only two of the 64 evaluated pollutants (benzidine - Plant A, and dichloromethane - Plant E) were projected to exceed human health

criteria at both the 25th and 50th percentiles. These two pollutants are known or suspected carcinogens; however, they are generally not persistent in water, having a half-lives of 6 hours or less. Only one pollutant (mercury) is projected to exceed chronic aquatic life criteria (Plant D). Another pollutant, zinc, is projected to exceed inhibition levels at the 25th percentile. No pollutants exceed the sludge contamination levels.

1.0 INTRODUCTION

This document presents the most current information available about the paint formulating industry point source category, and was prepared in response to recommendations of the DSS. It contains a description of the paint formulating process and the results of analyses of wastewater and waste solids obtained from sampling episodes. The document provides a technical basis for evaluating the need for regulation of the industry and can be used to assist permit writers and POTW officials in developing appropriate controls for the handling and disposal of wastewater and waste solids from the paint formulating industry.

A description of the paint formulating industry is presented in Section 3.0, and the industry subcategorization scheme is presented in Section 4.0. Section 5.0 characterizes paint industry wastewater flows and pollutant concentrations and loads. Pollutants of concern are identified in Section 6.0, and control and treatment technologies are discussed in Section 7.0.

1.1 Purpose and Authority

The Federal Water Pollution Control Act of 1972 (Clean Water Act, or CWA), as amended, established a comprehensive program to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Section 101(a)). The CWA required EPA to issue effluent limitations guidelines, pretreatment standards, and new source performance standards for 34 industrial categories. Effluent guidelines and standards for a portion of the paint formulating industry were promulgated in 1975. The paint formulating industry regulations were reviewed, following the EPA/NRDC Consent Decree in 1976; revised rules were proposed in 1980 (45 FR 912; January 3, 1980).

1.2 Legislative History - Solid Waste Disposal Act and Amendments

The Solid Waste Disposal Act (SWDA) of 1965 authorized limited research and grant programs to study solid waste disposal practices. However, authority and funds for research on domestic sewage disposal were not included in the SWDA, because Congress felt the funds for construction of wastewater treatment plants were available under the CWA to study and treat domestic sewage. This exclusion, the Domestic Sewage Exclusion (DSE) in the 1965 Act, was not regulatory in nature, and did not distinguish between solid and hazardous wastes.

The Resource Conservation and Recovery Act (RCRA), amending the SWDA, was passed in 1976. The DSE, included in Section 1004 (subparagraph 27) of the 1976 RCRA, states that solid or dissolved material in domestic sewage is not solid waste as defined in RCRA; therefore, such materials cannot be considered hazardous waste for RCRA purposes. The DSE applies to industrial wastes discharged to POTW sewers that contain domestic sewage, even if the industrial wastes would otherwise be considered

hazardous. Under the DSE, industrial facilities that discharge wastes to sewers containing domestic sewage are not subject to RCRA generator and transporter requirements (e.g., manifesting and reporting). In addition, POTWs receiving these wastes mixed with domestic sewage are not deemed to have received hazardous wastes; therefore, they need not comply with certain RCRA hazardous waste treatment, storage, and disposal requirements with respect to these wastes. The DSE does not, however, apply to sludge produced by a POTW as a result of wastewater treatment if the sludge is found to be a RCRA characteristic waste (under 40 CFR 261 Subpart C).

The 1980 regulations implementing the RCRA of 1976 interpreted the DSE to apply both to sanitary sewage and mixtures of sanitary sewage with other wastes in a sewer system. This interpretation was based on EPA's determination that the legislative policy reflected in the SWDA of 1965 would also exempt mixed wastestreams because they would be subject to control under the CWA. The preamble to the 1980 RCRA regulations stated that not only did the construction grants program provide financial assistance for the proper treatment of these wastes, but that proper pretreatment requirements would ensure that environmental problems would not result. The preamble to the rule published in 1980 did, however, point out that some mixtures of domestic sewage with other wastes may present environmental risks.

In 1984, the HSWA to RCRA added Section 3018(a), which required EPA to submit to Congress within 15 months of enactment of HSWA, a report concerning substances listed in Section 3001 that are not regulated under this subtitle by reason of the DSE. The report, known as the Domestic Sewage Study or DSS, included the types, sizes, and number of generators disposing of these substances to sewer systems. The report also identified significant generators, wastes, and waste constituents not regulated under existing federal law, or not regulated in a manner sufficient to protect human health and the environment.

The DSS was prepared by EPA's Office of Water Regulations and Standards and submitted to Congress on February 7, 1986. The DSS examined the nature and sources of hazardous wastes discharged to POTWs, measured the effectiveness of EPA programs in dealing with these discharges, and recommended improvements to the programs that would achieve better control of hazardous wastes entering POTWs. Section 3018(b) of HSWA required the Administrator, based on his review of the DSS, to evaluate existing regulations and develop and promulgate the additional regulations necessary to ensure that hazardous wastes discharged to collection systems/POTWs would be adequately controlled to protect human health and the environment. These regulations were to be promulgated pursuant to RCRA, Section 307 of the CWA, and any other appropriate authority of EPA.

In the DSS, EPA concluded that the DSE should be retained for the present time, and recommended ways to improve various programs administered under the CWA to obtain better control of hazardous

wastes entering POTWs. In addition, EPA recommended research efforts to fill certain information gaps, and indicated that other statutes (e.g., RCRA and the Clean Air Act) should be considered along with the CWA to control hazardous waste discharges to POTWs, if the recommended research indicated the presence of problems that can not be adequately controlled by the CWA.

One of the main recommendations of the DSS was that EPA review and amend categorical pretreatment standards (if necessary) to achieve better control of hazardous wastes. The DSS recommended that EPA modify existing standards to improve control of organic priority and non-priority pollutants, and that EPA promulgate standards for industrial categories and subcategories not included in the NRDC Consent Decree (NRDC v. Train; 8 ERC 2120; D.C.C.; 1976).

After considering the scope of the NRDC Consent Decree and the extent of Paragraph 8 exemptions, EPA found that some industrial sources of potentially hazardous waste discharges to POTWs may not be sufficiently regulated by existing categorical pretreatment standards. Among the industrial sources identified were paint formulating facilities.

In response to the conclusions and recommendations of the DSS, EPA began to collect additional data from the paint formulating industry and other industries.

This study was conducted under the authority of Sections 301(d) and 304(m) of the CWA, which require periodic review and revision of limitations promulgated pursuant to Sections 301, 304, and 306 of the CWA.

Section 301(d)

Any effluent limitation required by paragraph (2) of subsection (b) of this section shall be reviewed at least every five years and, if appropriate, revised pursuant to the procedure established under such paragraph.

Section 304(m)

Schedule for Review of Guidelines -

(1) Publication. Within 12 months after the date of the enactment of the Water Quality Act of 1987, and biennially thereafter, the Administrator shall publish in the Federal Register a plan which shall:

(A) establish a schedule for the annual review and revision of promulgated effluent guidelines, in accordance with subsection (b) of this section;

(B) identify categories of sources discharging toxic or nonconventional pollutants for which guidelines

under subsection (b)(2) of this section and Section 306 have not previously been published; and

(C) establish a schedule for promulgation of effluent guidelines for categories identified in subparagraph (b), under which promulgation of such guidelines shall be no later than four years after such date of enactment for categories identified in the first published plan or three years after the publication of the plan for categories identified in later published plans.

(2) Public Review. The Administrator shall provide for public review and comment on the plan prior to final publication.

1.3 Regulatory Background

Current regulations for the paint formulating industry are BPT, BAT, NSPS, and PSNS for the oil-based solvent wash subcategory of the paint formulating point source category. These regulations, promulgated in 1975, require no discharge of process wastewater pollutants. In 1980, EPA proposed BAT, PSES, NSPS, and PSNS for the caustic and/or water wash subcategory. However, after proposal, the water wash subcategory was excluded from further regulations pursuant to Paragraph 8 of the EPA/NRDC Consent Decree.

To update earlier facts, current information has been gathered by means of a literature search, telephone surveys with state and local environmental agencies, site visits to 10 paint formulating plants, meetings and conversations with NPCA representatives, and a sampling and analysis program.

Previous studies of the paint formulating industry completed by the EPA Effluent Guidelines Division (now the ITD) produced several documents. The initial task of this study was to review previous EPA work. Reports that provided background information are discussed in the following paragraphs.

1. Proposed Development Document for Effluent Limitations Guidelines and Standards for the Paint Formulating Point Source Category; EPA-440/1-79/049-b; 1979. This document was prepared by the EPA Effluent Guidelines Division and published in late 1979, in support of the January 1980 proposal. The information presented in the 1979 document was based on a study that occurred during the late 1970s, which included the sampling and analysis of 22 paint formulating plants. Also included in the document are the results of an analysis of information collected in a mail survey of paint formulating plants. This data collection portfolio (DCP) was designed to gather information for the unregulated segments of the paint industry. The DCP was mailed to 2,778 potential paint formulating facilities. Of those mailed, 1,374 questionnaires were completed and returned. The remaining DCPs were either mailed to facilities that were no longer in business, were not paint formulators, were duplicate

mailings, were mailed to people who did not respond, or were undeliverable. The survey was divided into seven major sections: general information, plant operations, production characteristics, tank and equipment cleaning, other wastewater sources, wastewater handling and disposal, and raw materials.

Analysis of the survey data resulted in an estimate of the number of direct, indirect, and zero discharge facilities, as well as useful information for the regulation development process.

2. Report to Congress, Minimization of Hazardous Waste (unpublished); Appendix B; EPA/530-SW-86-033; October 1986. Appendix B of the Report to Congress, Minimization of Hazardous Waste is part of a report written in response to Section 8002(r) of the HSWA of 1984. Section 8002(r) requires EPA to evaluate the desirability and feasibility of: (1) establishing performance standards or taking additional actions to require hazardous waste generators to reduce the volume or quantity and toxicity of the hazardous waste they generate; and (2) establishing (with respect to hazardous waste) required management practices or other requirements to ensure that wastes are managed such that present and future risks to human health and the environment are minimized. Appendix B presents a description of the paint industry, as well as an overall view of industry processes and waste generation. The industry description is geared toward solid waste generation and handling; however, it does refer to all types of wastes generated at a paint formulating facility, waste reduction, and waste handling.

3. Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works; EPA/530-SW-86-004; February 1986. This report, known as the DSS, was required by Section 3018(a) of the HSWA of 1984 to the RCRA of 1976. The DSS, as discussed previously, examined the nature and sources of hazardous wastes discharged to POTWs, measured the effectiveness of EPA programs, and recommended ways to control the discharge of hazardous waste discharges to POTWs.

4. The U.S. Paint Industry: Technology Trends, Markets, Raw Materials; SRI International; September 1986. This report, published semiannually for the National Paint and Coatings Association (NPCA), updates information on the economic aspects of the industry, market trends, consumption of paint, raw materials, and other related information.

5. The Paint Red Book; 18th Edition; 1986. The Paint Red Book is a comprehensive directory of paint formulators and suppliers to the paint and coatings formulating industry.

6. Kline Guide to the Paint Industry; Sixth Edition; 1981. This document provides a summary of the economics of the industry, an analysis of major product groups, a directory of 400 major paint companies, and a summary of information available from industry organizations, publications, and technical and statistical literature.

TECHNICAL SUPPORT STUDY

2.0 INTRODUCTION TO TECHNICAL SUPPORT STUDY

Sections 2 through 7 of this document provide a technical study of the paint formulating industry focused primarily on waste generation and characterization and wastewater treatment. The study reviews previous EPA wastewater studies of the paint formulating industry and updates the EPA data base.

2.1 Introduction

The technical study provides an updated profile of the paint formulating industry, and chemical analyses of wastewater and waste solids obtained from recent sampling episodes and recent wastewater monitoring data obtained from state and local authorities. The document provides a technical basis which can be used to determine whether regulations should be developed for this industry. The document will also serve as a summary of information which can be used by permit writers and POTWs in controlling hazardous wastes discharges from paint plants.

The paint formulating subcategory is defined and described in Section 3 and subcategorization is reviewed in section 4. Section 5 characterizes paint formulating wastewaters in terms of flow, concentrations and loads. Pollutants of concern are identified and discussed in Section 6, and control and treatment technologies are discussed in Section 7.

2.2 Study Methodologies

Previous data were reviewed, data gaps and requirements were determined, and industry comments and assistance were obtained in meetings with NPCA personnel, specifically the NPCA Water Quality Task Force Group.

Information to update our data base and identify candidate plants for sampling was obtained from the following sources:

- NPDES permit files
- telephone interviews with and visits to personnel at EPA regional offices, state offices, and paint formulating plants
- literature searches, including research reports, journals and magazines, and computer data bases

This information was obtained to update industry process descriptions, review subcategorization, identify pollutants of potential interest to determine pollutant treatability, and identify candidate treatment technologies and waste control practices.

As a result of previous data gathering efforts, detailed information was collected, and it served as the basis for the existing industry profile presented in the Development Document. Information collected during the present study has been used to

update earlier information, relating to process operations, wastewater volumes and characteristics, and handling and disposition of wastewater and sludge. The current literature about the industry was reviewed, and the data obtained during the data collection efforts (including the current sampling program) were evaluated.

A program was undertaken to collect and analyze samples of wastewater, waste solids, and/or waste solvents at paint formulating facilities. EPA relied on its existing database and the advice and assistance assistance of the NPCA staff to identify ten paint formulating facilities for site visits; four of the ten were selected for sampling (Plants A, B, C, and D). Two facilities were 100 percent water-base paint formulators, one was a 100 percent solvent-base paint formulator, and one formulated both water- and solvent-base paint.

During sampling at the two water-base paint formulators, samples of raw wastewater from tank and equipment cleaning operations, treated wastewater, and sludge generated from the treatment process were collected. During sampling at the solvent-base paint formulator, samples of waste solids generated from a solvent steam distillation unit were collected. During sampling at the facility that formulated both types of paint, samples of raw wastewater, treated wastewater, waste solids generated from the treated wastewater, spent solvent, and spent caustic were collected.

The wastewater samples were analyzed for conventional, toxic, and nonconventional pollutants on the ITD List of Analytes. Solids samples were analyzed for the same parameters, except that wet chemistry methods were not generally used, and dioxins were analyzed for when appropriate. In addition, sludge leachate from solids samples, processed according to the proposed toxicity characteristics leaching procedure (TCLP), were analyzed for the compounds on the ITD List of Analytes.

As part of the Agency's review of the analytical data, the amounts, frequency of occurrence, and toxicity of pollutants found in paint formulating industry wastes are presented and discussed in this document.

3.0 DESCRIPTION OF THE INDUSTRY

As defined by Standard Industrial Classification (SIC) Manual (1972), Code 2851, the paint and allied products industry is composed of "establishments primarily engaged in the manufacture of paints (in paste and ready-mixed form); varnishes; lacquers; enamels and shellac; putties; wood fillers and sealers; paint and varnish removers; paintbrush cleaners and allied paint products." Establishments engaged in the manufacture of pigments (organic or inorganic), resins, printing inks, adhesives and sealants, or artist materials are not included in SIC 2851. The information and discussion presented in this report addresses only the formulation and packaging of water- and solvent-base paints.

The major products of the paint industry are architectural coatings (usually water-base) and industrial coatings (usually solvent-base). Architectural coatings are also referred to as trade sales paints, which are primarily off-the-shelf exterior and interior paints for buildings and other structures. A large percentage of paint used for architectural coating is water-based (i.e., more than 70 percent). Industrial coatings, also referred to as chemical coatings, are sold to manufacturers for factory application to such products as automobiles, aircraft, furniture, and machinery. A large percentage of paint used for industrial coatings is solvent-based.

Special-purpose coatings, primarily solvent-based, are formulated for special applications and/or special environmental conditions (e.g., extreme temperatures, chemicals, and fumes). The major market segments for special coatings include marine, automotive refinishing, highway and traffic markings, aerosol paints, and miscellaneous. Special purpose coatings accounted for approximately 15 percent of the total 1985 industry production. Amounts of products formulated by the paint industry in 1985 are shown in Table 3-1.

3.1 Industry Profile

Detailed information on the paint formulating industry was developed from the 1979 Proposed Development Document.

The basic steps involved in the formulating of paint have not changed significantly since the collection of information supporting the 1980 proposal. The number of paint formulating facilities in the U.S. has decreased somewhat; the proportion of water-base to solvent-base paint production has increased signif-icantly: and, the most significant change, has been a trend toward eliminating the discharge of process wastewater and pollutants, either to receiving waters or municipal treatment works (POTWs).

TABLE 3-1
1985 PAINT PRODUCTS BY TYPE AND END USE[3]

Architectural Coatings	465 million gallons
Industrial Coatings	380 million gallons
Metal Containers	15%
Automotive	12%
Machinery	10%
Sheet, Strip, and Coil	5%
Metal Furniture	7%
Wood Furniture	14%
Wood Flat Stock	4%
Other[1]	32%
Special-purpose Coatings	156 million gallons
Special Maintenance	19%
Aerosols	10%
Auto Refinishes	25%
Traffic	28%
Other[2]	18%

1 Includes appliances, other transportation, marine, and paper and foil.

2 Includes roof, bridge, marine shelf goods, and metallic.

3 SRI - International - Sept. 1986 - U.S. Paint Industry

Approximately 1,170 companies operate the estimated 1,440 paint plants which employ about 54,600 people. According to the 1982 Census of Manufacturers, 28,000 people are directly involved in the formulating and packaging of paint. Plant size, in terms of employees per plant, is relatively small. The Census of Manufacturers indicates that more than half of the plants employ less than 20 employees each. Approximately half of the 1,441 plants listed in the 1982 Census of Manufacturers are located in five states (i.e., California, New Jersey, New York, Illinois, and Ohio). About two-thirds of all paint formulating plants are located in 10 states.

Paint formulating facilities may generate significant quantities of both priority and non-priority hazardous constituents. Earlier studies of the industry, conducted after passage of the 1977 amendments to the CWA, revealed that high concentrations of various priority pollutants (e.g., carbon tetrachloride, benzene, ethyl benzene, methylene chloride, phenol, toluene, zinc, lead, mercury, copper, nickel, cadmium, and chromium), and non-conventional and non-priority hazardous constituents (e.g., aluminum, iron, acetone, methanol, and N-butyl alcohol) are generated.

Based on information currently available, most facilities generate less than 500 gallons per day (gpd) of process wastewater. Based on industry sources, it has been estimated that less than half of the paint formulating facilities discharge process wastewater to POTWs; the remaining majority of facilities do not discharge process wastewater either directly or indirectly.

3.2 Industry Processes

Paint formulating plants usually produce only one type of paint [i.e., either architectural (water-base) or industrial coatings (solvent-base)] at a given facility. A relatively small percentage of the total number of plants produce both types of paint at the same facility.

3.2.1 Solvent-base Paint Formulation

There are three major steps involved in the solvent-base paint formulation and packaging process: (1) mixing and grinding of raw materials; (2) tinting and thinning; and (3) filling operations. Figure 3-1 illustrates these steps.

The production of solvent-base paint begins by mixing portions of the resin, surfactant, and solvent together in a high-speed mixer. During this operation, pigments and extenders are also added. Following the mixing operation, the batch is transferred to some type of dispersing equipment, including pebble, sand, or ball mills. The type of dispersion equipment used depends on the

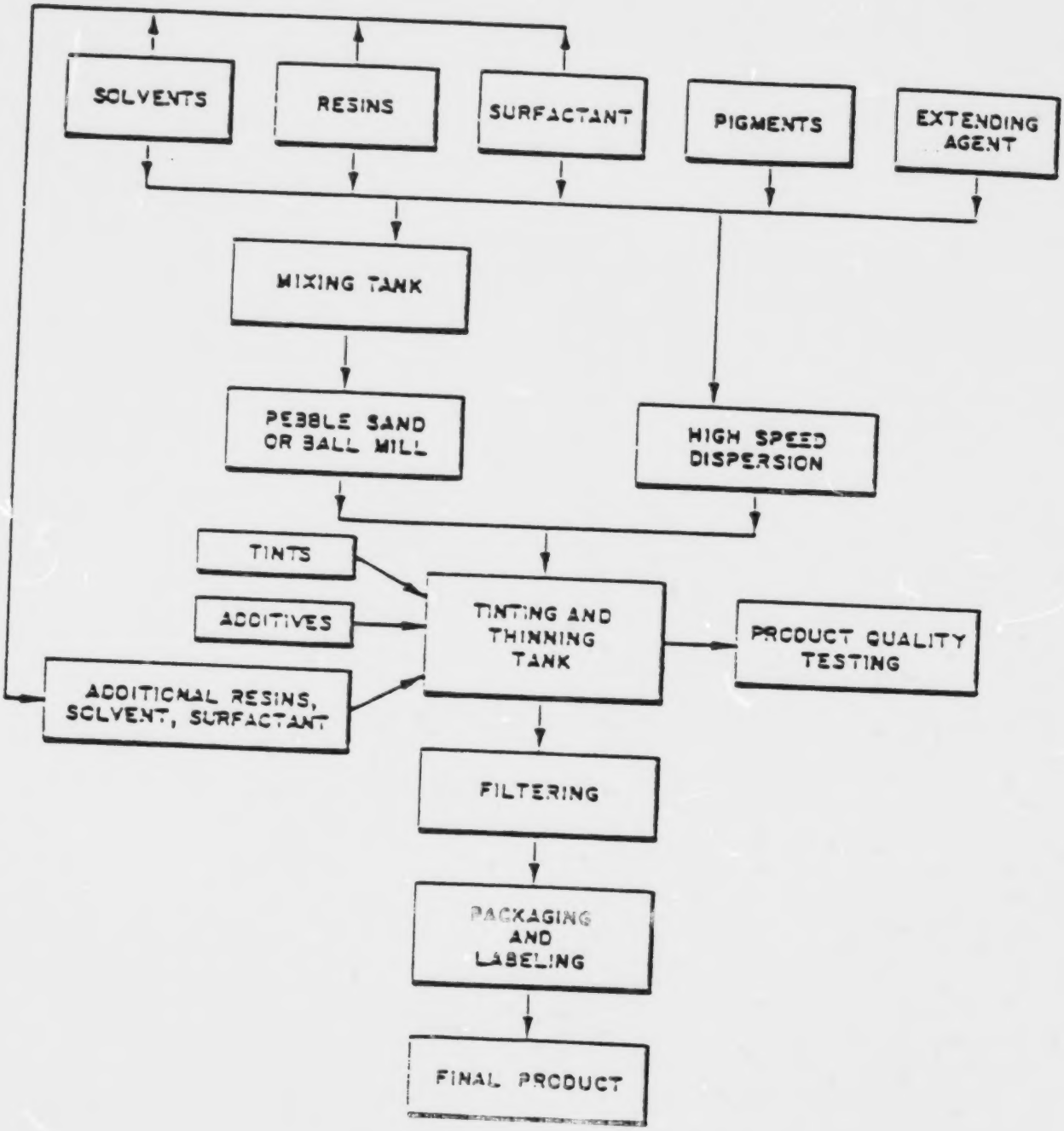


FIGURE 3-1
GENERAL FLOW DIAGRAM OF FORMULATION PROCESS FOR SOLVENT-BASE PAINTS

type of pigment being handled and the nature of the paint being formulated. Mixing and dispersing operations can occur simultaneously in a high-speed mixer when the gloss, texture, and consistency are not as critical as in a special-purpose coating. After dispersion, the batch is transferred to an agitated tank where tints, thinner (solvent), and additional resin and surfactant are added. Additives such as adhesion promoters, anti-floating agents, anti-foaming agents, and corrosion inhibitors may be added at this point as well. After product quality testing and adjustment (if necessary), the paint is filtered to remove any non-dispersed solids and then transferred to a loading hopper. From the hopper, the paint is poured into cans, labeled, packaged, and moved to storage.

Paint on the sides of the tanks may be allowed to drain naturally, and the remaining "clingage" is cleaned with a squeegee until only a small quantity of paint remains. The final cleanup of the tanks generally consists of flushing with a solvent. The used solvent is treated in one of three ways: (1) it is used in the next paint batch as part of the formulation; (2) it is collected in drums that are sold to a company where it is redistilled and resold; or (3) it is collected in drums for subsequent tank-cleaning operations and returned to the drums. Ultimately, sludge settles in the drum. The sludge is disposed of in an approved landfill.

Some plants clean solvent-base paint tanks and equipment with hot caustic, either on a regular or periodic basis. The caustic is generally recycled, and the caustic cleaning is followed by a water rinse. Part of this rinse water is returned to the caustic tank as make-up, and any remaining water is disposed of by (1) discharging to the sewer or receiving water; (2) holding, treating, and discharging to a sewer or receiving water; (3) drumming and landfilling; or (4) reusing as rinse water.

3.2.2 Water-base Paint Formulation

Water-base paints are produced in a slightly different manner than solvent-base paints. The pigments and extending agents are usually purchased in the appropriate particle size. The pigment, extenders, surfactant, and resin are then dispersed in water with a saw-toothed, high-speed mixer. Small plants thin and tint the paint in the same tank; larger ones transfer paint to special tanks for thinning and tinting. When the formulation is correct, the paint is transferred to a filling operation where it is filtered, packaged, and labeled in the same manner as solvent-base paints. The formulation process for water-base paints is diagrammed in Figure 3-2.

As in the solvent-base paint operation, as much product as possible is removed from the sides of the tub or tank before final cleanup. For the water-base paint tubs, cleanup involves

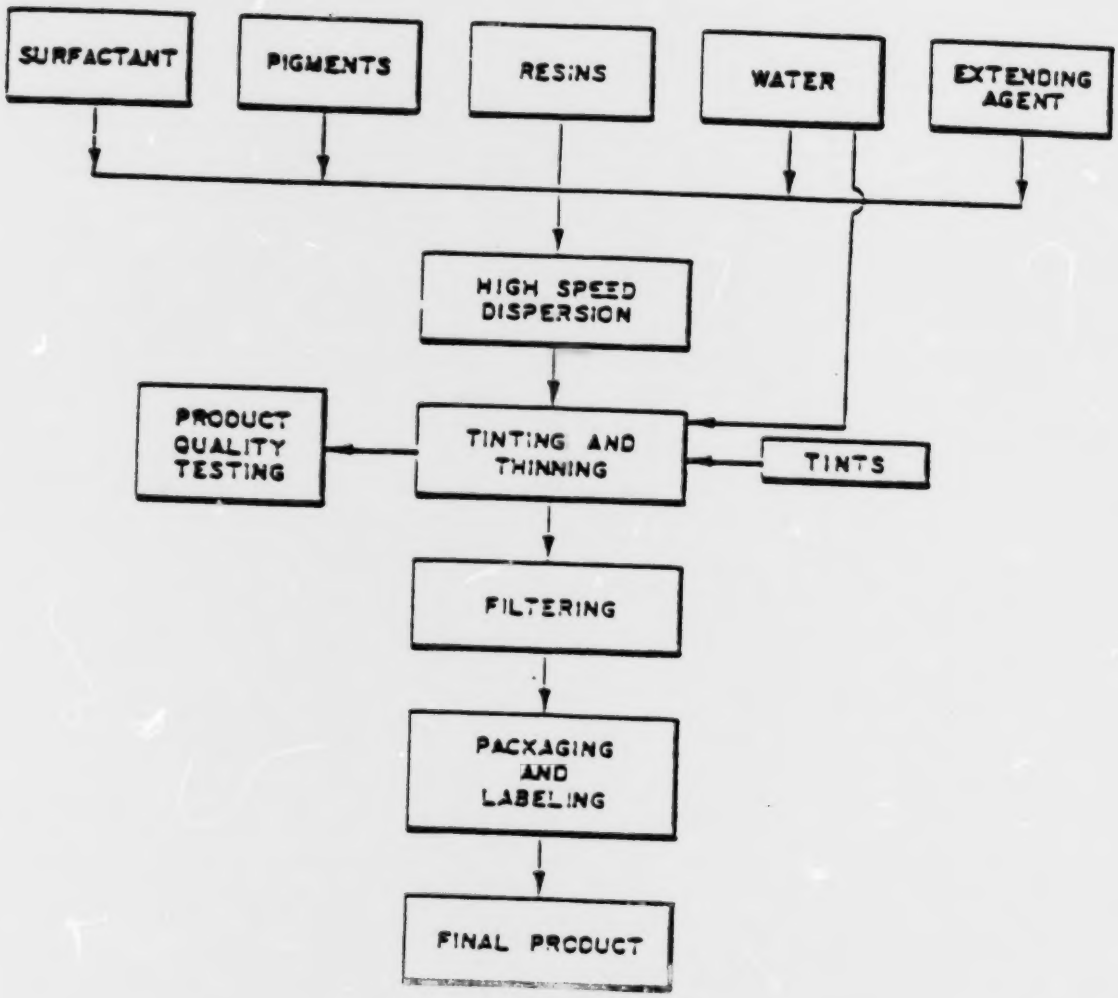


FIGURE 3-2
GENERAL FLOW DIAGRAM OF
FORMULATION PROCESS FOR WATER-BASE PAINTS

washing the sides with either a garden hose or a more sophisticated washing device. The wash water may be (1) collected in holding tanks and treated before discharge; (2) collected in drums and taken to a landfill; (3) discharged directly to a sewer or receiving stream; (4) reused in the next paint batch; or (5) reused in the washing operation.

Some paint plants regularly or occasionally rinse water-base paint tanks and equipment with hot caustic, in a manner similar to that described for solvent-base paints. Any rinse water generated is combined with the regular clean-up water, and disposed of by one of the same methods.

4.0 INDUSTRY SUBCATEGORIZATION

The "Development Document for Effluent Limitations Guidelines and Standards for the Paint-Formulating Point Source Category - Proposed (1979)" identified the following factors for consideration in developing a subcategorization scheme:

- raw materials and products
- production methods
- size and age of production facilities
- wastewater characteristics
- tank-cleaning techniques

EPA concluded that tank-cleaning techniques offer an appropriate basis for subcategorizing the paint industry.

The Federal Register notice announcing the proposed rule (42 FR 912, January 3, 1980) suggested the following two subcategories for the paint-formulating industry:

1. paint formulating plant which, either exclusively or in addition to other operations, produces solvent-base or oil-base paints where equipment cleaning is performed using organic solvents

2. paint formulating plant which, either exclusively or in addition to other operations, produces water-base or solvent-base paints where equipment cleaning is performed using water or caustic solution.

Following publication of the proposed rule, the paint formulating industry was excluded, under authority of Paragraph 8 of the modified Consent Decree, from further regulation under the CWA. Therefore, Item 2 was not finalized (promulgated). For the purpose of this document, the proposed subcategories for the industry are appropriate.

5.0 WATER USE AND WASTE CHARACTERISTICS

5.1 Wastewater Sources

The primary source of wastewater in paint formulating operations is the rinsing of tanks and filling equipment. Wastewater sources also include cleaning, spills, laboratory and plant sinks, boiler and cooling water blowdown, air pollution control devices, and the cleaning of raw material tank cars or trucks. Most paint formulating facilities segregate non-contact cooling water and sanitary wastewater from the process, and either discharge the non-paint formulating wastewaters directly to the sewer without pretreatment or to a wastewater treatment system.

Paint formulation involves three basic steps: dispersing, or mixing, of raw materials; tinting and thinning; and filling and packaging. Some facilities combine the first two steps by using high-solids dispersion equipment for dispersing, mixing, thinning, and tinting in the same tank. Other facilities mix or disperse, and then transfer to a thinning/tinting vessel. When the steps occur in separate vessels, dispersion tanks or ball mills generally are cleaned by rinsing with solvent or water (depending on the base of the particular paint batch). Caustic rinses may follow either solvent rinses or water rinses. Many plants routinely use a caustic-washing system for small portable tanks or tote bins, while fixed tanks are cleaned with caustic only when the build-up of paint residue makes it necessary.

5.1.1 Solvent-base Paint Formulation

Rinsing of solvent-base paint tanks results in a waste solvent, which is generally handled in one of three ways:

- used in a subsequent compatible batch of paint as part of the formulation
- collected and redistilled, by the plant or by an outside contractor, for subsequent resale or reuse
- reused, with or without treatment (i.e., usually settling), to clean tanks and equipment until spent; sludge or solvent is then drummed and disposed of in an approved site, usually by contract hauling

5.1.2 Water-base Paint Formulation

Wastewater from water-base paint tanks and equipment-cleaning operations is usually handled in one of three ways:

- reused in a subsequent compatible batch of paint as part of the formulation
- reused, with or without treatment, to clean tanks and equipment until spent; after settling the sludge is disposed of in an approved site, usually by contract hauling; and the decant is drummed

- drummed, without reuse, and disposed of in an approved site, usually by contract hauling

5.1.3 Caustic Cleaning Operations

Plants with caustic rinse systems generally use water to rinse the caustic residue from tanks; however, a few plants allow the caustic water to evaporate from the tanks. Evaporation of caustic water, however, often results in odor problems, and the caustic residue can have a negative effect on the quality of some paint formulations. Several types of caustic rinse methods are used by the paint industry; for cleaning fixed tanks, two methods are common:

- The caustic is kept in a holding tank (usually a heated tank), and is pumped through fixed piping or flexible hoses to the tank to be cleaned. Often a portable hood is placed over the tank. Nozzles are used to direct the caustic spray. After the cleaning operations are completed, the caustic is returned to the holding tank.

- The caustic solution is prepared in the tank to be cleaned, and the tank is soaked until clean. The caustic solution is either transferred to the next tank to be cleaned, stored for subsequent use in drums or tanks, or disposed of by contract hauling.

For cleaning small portable tanks, three methods are common:

- The caustic is kept in a holding tank (usually heated) and pumped through fixed piping or flexible hoses to the tank to be cleaned. After cleaning, the caustic drains to either a floor drain or a sump, and then is pumped back to the holding tank, or, is pumped directly back to the holding tank.

- Small tanks are put into a strainer device and dipped into an open-top, caustic holding tank until clean.

- The tanks are placed in a dishwasher-like device that circulates hot caustic solution, followed by a water rinse.

The water rinse following a caustic wash is rarely reused in a subsequent batch of paint. Following are the two common methods for handling this rinse:

- recycling it to the caustic rinse solution
- drumming it for contract hauling

Most plants reuse the caustic solution until it loses its cleaning ability. The caustic then is usually disposed of by contract hauling; however, sometimes the pH is adjusted to near neutral, and the solution is discharged to a treatment facility.

5.2 Wastewater Volume

The amount of water used to clean tanks of various sizes is summarized in Table 5-1. The information presented is based on an analysis of the responses to the 1977 DCP returned by the operators of more than 1,300 paint formulating facilities.

The amount of water generated by tank cleaning is influenced by the water pressure used. Paint formulating facilities that use high-pressure water for tank-cleaning operations tend to generate a smaller volume of wastewater per batch of paint produced than facilities that use low-pressure water.

In addition to water pressure, another factor affects the amount of wastewater generated per batch of paint produced; that is, the presence of floor drains, which often results in the increased use of water. The tendency to use water for cleaning is greater when there is a place for it to drain. In the absence of floor drains, troughs, or ditches, dry cleaning methods are often used (e.g., rags, squeegees, vacuum pick-up devices).

Many plants, especially newer ones, have installed ditches that drain to sumps, which pump directly to a wastewater treatment or recycling system. In this set-up, wastewater generation can be somewhat better controlled.

An analysis of responses to the 1977 DCP indicated that the total wastewater generated by the paint industry was between 750,000 and 1,500,000 gallons per day. However, NPCA's comments on the 1980 proposed regulation stated that this estimate of wastewater generation was inaccurate. In their opinion, questions asked in the DCP concerning wastewater generation and discharge were misinterpreted. NPCA felt that questions regarding wastewater did not clearly differentiate between wastewater generation and wastewater discharge. Facilities responding to the DCP had included wastewater generated from sources other than the paint formulating processes in their responses. Thus, quantities of process wastewater generated and discharged were reported larger than the actual quantities.

TABLE 5-1

AMOUNT OF WATER USED TO CLEAN A PAINT TANK

Tank Size	0-60 gal.	61-100 gal.	101-200 gal.	Over 200 gal.	Total
	Percent of Plants Responding				
Under 250 gal.	97.9	1.6	0.4	0.1	100%
251-500 gal.	90.1	7.1	1.9	0.9	100
501-1000 gal.	79.6	13.5	3.1	3.8	100
1001-1500 gal.	62.9	22.5	9.6	5.1	100
1501-2500 gal.	54.8	22.0	11.3	11.9	100
2501-6000 gal.	38.7	26.7	18.8	15.8	100
Over 6000 gal.	59.4	15.6	12.5	12.5	100

Source: Proposed Development Document for Effluent Limitations Guidelines and Standards for the Paint Formulating Point Source Category: EPA-440/1-79/049-b; 1979, Table V-2

The paint formulating industry has, since the late 1970's, significantly increased the rate of reuse and recycling of process water and solvents. The total industry process wastewater volume discharged, or otherwise disposed of at this time, is much lower than the volume estimated in the 1979 support document. In order to develop an accurate estimate of current industry wastewater volume it will be necessary to distribute a new survey to a statistically valid segment of the paint formulating industry.

5.3 Wastewater Characterization

5.3.1 Background

In an effort to characterize the occurrence of conventional pollutants and metals in wastewater from the paint formulating industry, relatively current information was assembled.

Data presented in Appendix I of the DSS report are from the 1985 sampling of one paint formulating facility. Samples of raw wastewater, supernatant after flocculation, wastewater sludge, and spent caustic were collected. At the time of the sampling episode, approximately 95 percent of the paint formulation at the facility was water-base paint, and approximately 5 percent was solvent-base paint. Plant personnel estimated that 75 percent of the wastewater generated at the time of sampling was from the washdown of tanks and filling equipment. The remaining 25 percent was estimated to be generated from floor and spill cleanups. In 1984, an average of 2,000 gpd of wastewater generated from water-base paint formulation was discharged to the municipal treatment system. Treatment consisted of adding a flocculant (i.e., Amerfloc 485) to the collected wastewater and allowing the solution to settle for 30 to 90 minutes. The supernatant was pumped to a second collection tank and visually checked prior to discharge to the municipal treatment system. As the treated wastewater was discharged to the sanitary sewer, it was filtered to collect any fine solids. Typically, the sludge that collected in the bottom of the treatment tank was handled in one of two ways:

- the sludge was pumped to a truck pick-up bin located outside the production building to be taken by a contract hauler to a landfill approved for hazardous material

- the sludge was pumped to a third collection tank for further concentration if a higher percentage of solids was desired before discharge to the pick-up bin

Three locations were sampled: a holding tank containing raw wastewater, a treatment tank holding treated wastewater, and a tote tank containing spent caustic. The samples were analyzed for approximately 400 hazardous/toxic pollutants. The analytical results are summarized in Table A-1 of Appendix A.

The 1976 Draft Development Document, prepared by Burns and Roe, included a sampling program of treated and untreated paint process wastewater streams and sludge from nine paint formulating plants. Average untreated and treated wastewater concentrations for metals, conventional and non-conventional pollutants from the 1976 sampling program are presented in Tables A-2 and A-3 of Appendix A.

The 1979 Development Document presented data from sampling and analysis of 22 paint formulating plants in 1977-78. A summary of the analytical data for the pollutants from each of the 22 paint plants is presented in Tables A-4 through A-6 of Appendix A. These tables summarize the number of times each pollutant was analyzed for, and the number of times each pollutant was found above the detection limit. The average (mean), median, minimum, and maximum values are also presented. For many parameters in paint wastewater, the average value is significantly higher than the median value. This may be caused partly by the variability between batches, and the limited amount of data. In some instances, the minimum, maximum, and median values are all less than the detection limit; in these cases, the average values were reported as the detection limit. Because the raw data from which the tables were developed are no longer available, the data presented in the tables cannot be verified.

Samples were taken, and test results are noted for intake tap water (Table A-7), untreated wastewater (Table A-4), treated wastewater (Table A-5), and sludge (Table A-6). These samples were analyzed for 126 priority pollutants. Of the 22 plants reported in the 1979 Proposed Development Document, 17 treated wastewater by a batch physical-chemical (P-C) treatment system, using chemical addition, mixing, and settling. Three plants used a continuous system with the same unit operations as the batch P-C plants. The two remaining plants used neutralization and gravity separation.

5.3.2 Sampling and Analytical Results

As discussed in Section 2.0, four plants were selected for sampling in 1986 and 1987. Liquid and solid samples were collected and analyzed for conventional, non-conventional, and toxic pollutants. Solid samples, if collected, were also analyzed for their toxicity characteristic contaminants per Fed. Reg. Prop. Rules, 6/13/86 Part 261, Toxicity Characteristics Leaching Procedure (TCLP). This procedure requires that an extraction be performed on the sludge sample under precise conditions. Then tests are performed on the extract, or suspending liquid if a low solids sludge (<0.5% solids), to detect any of 52 "Toxicity Characteristic Contaminants." Additional tests (including volatiles) may be performed on the sludge extract using the specific test procedures and preparations cited in Section 261.24. If the extract concentration levels, noted in Table I of Section 261.24, are equaled or exceeded, then the waste sludge is considered to exhibit the characteristics of toxicity and to be above regulatory levels. All samples were analyzed for pollutants on the ITD List of Analytes, which

includes over 300 organic pollutants previously identified as toxic and/or hazardous by the Office of Solid Waste (RCRA, Appendix VIII), various states (e.g., Michigan and California), the Superfund Hazardous Substance List (HSL), the CWA Appendix C pollutants, Paragraph 4(c) pollutants, VTOX Chemicals, and the Priority Pesticides Review List, as well as compounds on the original Priority Pollutants List. These pollutants are listed in Appendices B and C.

The following paragraphs describe each of the facilities sampled, including production information, treatment processes, and reuse and recycling procedures.

Paint Plant A. The product from Plant A is 100 percent water-base paint; approximately 7 million gallons are produced per year, 70 percent of which is white paint. This plant operates eight hours per day, five days per week. Approximately 8,000 gallons of paint wastewater (i.e., two treatment tank batches) is generated daily. The wastewater treatment system consists of four 5,000-gallon collection and/or treatment tanks and a vacuum filter system for sludge dewatering.

The major source of wastewater is from the rinsing of mixing tanks and filling equipment. Additional wastewater is generated by floor and spill cleaning and plant sinks. The wastewater is collected in a 5,000-gallon tank for treatment. Aluminum sulfate is added to the treatment tank containing wastewater to create a floc, which is then allowed to settle for approximately 25 minutes to 1 hour before discharge. Sample points are indicated in Figure 5-1. All in-plant test data from Plant A are summarized in Table 5-2. Solid waste is generated as sludge from the vacuum dewatering system.

Grab samples were collected at three locations: a 5,000-gallon holding tank containing raw wastewater; a 5,000-gallon treatment tank containing treated wastewater; and a 5,000-gallon sludge holding tank.

Paint Plant A discharges approximately 8,000 gpd (i.e., two batches) of treated process wastewater.

Paint Plant B. The product from Plant B is 100 percent water-base paint; approximately 2 million gallons are produced per year. This plant operates eight hours per day, five days per week. Approximately 8,000 gallons of paint wastewater are

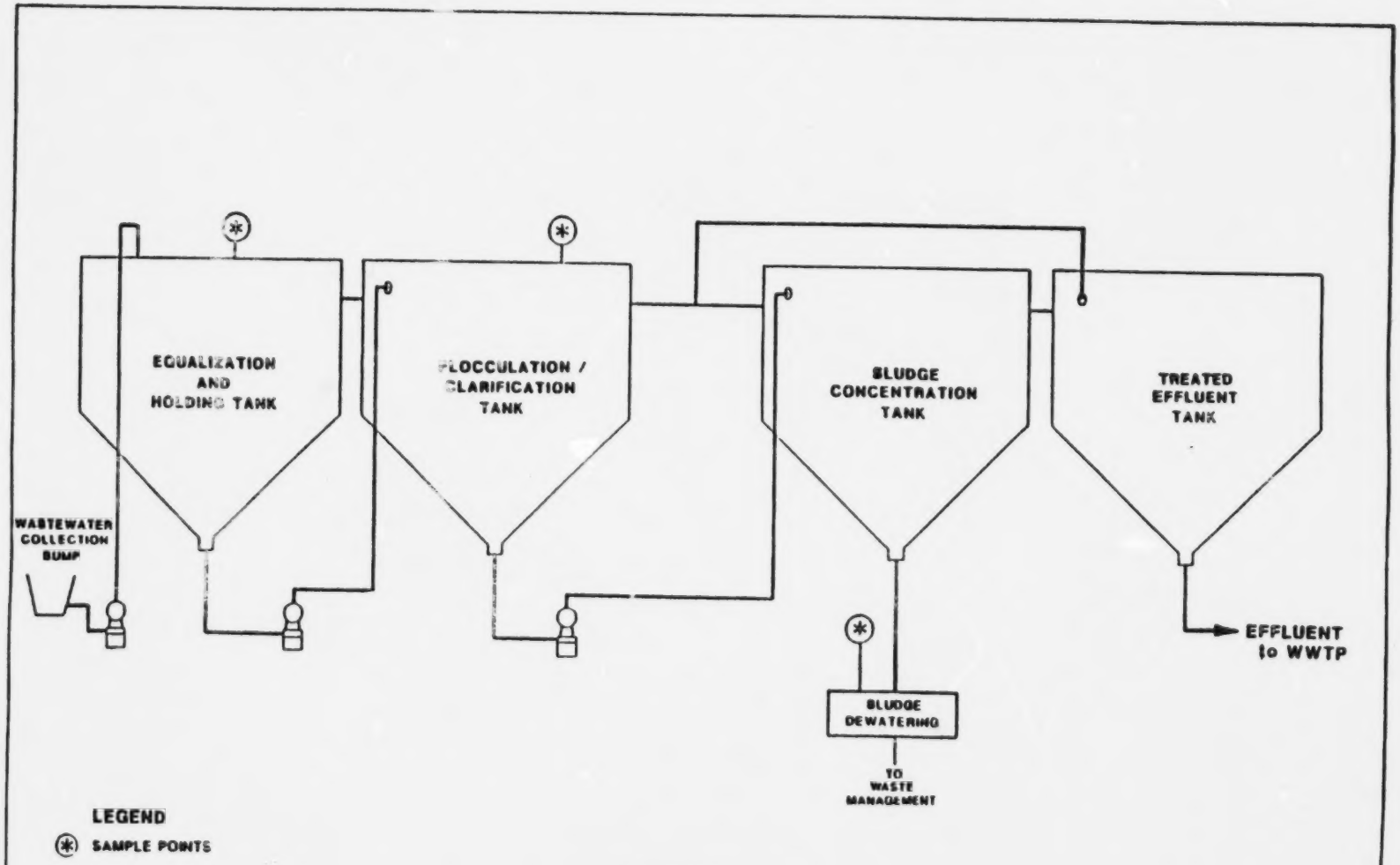


FIGURE 5-1
WASTEWATER TREATMENT SYSTEM
PAINT PLANT A

TABLE 5-2
SUMMARY OF ANALYTICAL RESULTS
PAINT PLANT A

Pollutant Category and Pollutant	Raw Waste Day 1 (Liquid) µg/ℓ	Treated Waste Day 1 (Liquid) µg/ℓ	Treated Waste Day 1 (Replicate) µg/ℓ	Raw Waste Day 2 (Liquid) µg/ℓ	Treated Waste Day 2 (Liquid) µg/ℓ	Solid (Sludge) µg/kg	TCLP Extract (Sludge) µg/ℓ
Type 1 Organics							
acetone	--	734	--	--	715	--	--
alpha-terpineol	--	5,169	--	--	--	--	--
benzidine	5,233	--	--	--	--	--	--
methylene chloride	136	--	--	--	357	--	--
n-octacosane	5,135	--	--	--	--	--	--
n-tetracosane	6,919	--	--	--	--	--	--
1,1-dichloroethane	313	306	--	--	--	--	--
1,1,1-trichloroethane	--	581	--	1,229	--	--	--
2,6-dinitrotoluene	--	--	--	--	3,917	--	--
tetrachloroethene	--	--	--	--	--	26	15
ethylbenzene	--	--	--	--	--	--	13
Type 2 Organics							
thioxanthone	--	--	--	--	--	1,886	--
Pesticides/Herbicides							
phosmet	--	--	--	18t	--	NA	NA
Purgeable Organic Compounds (TVO)	56,000	4,800	60,000	41,000	78,000	5,400,000	NA
Dioxins/Furans							
None Detected							

-- Tested, but lower than detection limit

TABLE 5-2
(continued)

Pollutant Category and Pollutant	Raw Waste Day 1 (Liquid) µg/ℓ	Treated Waste Day 1 (Liquid) µg/ℓ	Treated Waste Day 1 (Replicate) µg/ℓ	Raw Waste Day 2 (Liquid) µg/ℓ	Treated Waste Day 2 (Liquid) µg/ℓ	Solid (Sludge) mg/kg	TCLP Extract (Sludge) µg/ℓ
Metals							
calcium	858,000	108,000	113,000	224,000	95,000	17,300	258,000
magnesium	49,000	30,000	31,000	41,000	36,000	593	6,540
sodium	84,000	357,000	383,000	110,000	198,000	941	1,810,000
aluminum	424,000	806	859	138,000	1,790	14,300	13,000
manganese	3,060	224	234	1,090	179	118	571
lead	211	--	--	56	--	55	--
vanadium	299	--	2.5	127	26	10	--
boron	136	155	230	131	126	19	--
barium	1,720	102	104	2,830	271	271	1,580
beryllium	2.7	--	--	--	--	--	--
cadmium	21	--	--	--	--	4	10
molybdenum	--	--	--	16	--	40	100
tin	554	--	--	386	--	45	--
yttrium	41	--	--	--	--	--	--
cobalt	76	--	--	5.3	--	10	--
chromium	228	--	--	82	--	18	--
copper	167	--	--	250	--	10	--
iron	132,000	81	74	195,000	335	12,600	139
nickel	126	--	--	52	--	--	63
titanium	4,650	10	--	2,000	--	446	--
zinc	155,000	5,810	6,100	11,300	872	3,030	297,000
silver	2.7	--	--	--	--	--	--
antimony	51	43	131	331	514	--	66
mercury	--	--	--	--	--	0.14	--
Elements							
erbium	DET	--	NA	DET	--	DET	NA
germanium	DET	--	NA	--	--	--	NA
iodine	DET	--	NA	DET	--	--	NA

TABLE 5-2
(continued)

Pollutant Category and Pollutant	Raw Waste Day 1 (Liquid) mg/ℓ	Treated Waste Day 1 (Liquid) mg/ℓ	Treated Waste Day 1 (Replicate) mg/ℓ	Raw Waste Day 2 (Liquid) mg/ℓ	Treated Waste Day 2 (Liquid) mg/kg	Solid (Sludge) mg/kg	TCLP Extract (Sludge) mg/ℓ
potassium	DET	DET	--	DET	DET	--	NA
phosphorus	DET	--	--	DET	--	DET	NA
praeseodymium	DET	--	--	--	--	--	NA
sulfur	DET	DET	--	DET	DET	DET	NA
selenium	DET	--	--	DET	--	--	NA
silicon	DET	DET	--	DET	DET	DET	NA
strontium	DET	--	--	--	--	--	NA
thallium	DET	DET	--	DET	DET	DET	NA
tungsten	DET	--	--	--	--	--	NA
Conventional Pollutants							
BOD-5 Day (carbonaceous)	6,000	>3,400b	3,400	1,700	1,500	NA	NA
oil and grease, total recoverable	470	62	70	160	33	NA	NA
pH, soil	NA	NA	NA	NA	NA	7.5	NA
residue, non-filterable	33,000	40	47	20,000	76	NA	NA
Non-conventional Pollutants							
residue, filterable	8,100	2,400	2,400	5,500	1,700	NA	NA
fluoride	0.32	0.28	0.26	0.28	0.25	NA	NA
ammonia, as N	24	30	31	16	14	140	NA
nitrogen, Kjeldahl, total	120	81	83	44	42	1,100	NA
nitrate-nitrite, as N	0.14	0.38	0.42	0.14	0.05	--	NA

TABLE 5-2
(continued)

Pollutant Category and Pollutant	Raw Waste Day 1 (Liquid) mg/ℓ	Treated Waste Day 1 (Liquid) mg/ℓ	Treated Waste Day 1 (Replicate) mg/ℓ	Raw Waste Day 2 (Liquid) mg/ℓ	Treated Waste Day 2 (Liquid) mg/kg	Solid (Sludge) mg/kg	TCLP Extract (Sludge) mg/ℓ
total phosphorus, as P	--	0.16	0.13	--	0.66	NA	NA
chemical oxygen demand	34,000	6,8000	7,100	17,000	3,600	NA	NA
total organic carbon	4,900s	2,500	2,400	1,100s	740	NA	NA
corrosivity						<10	

b Oxygen depletion exceeded
s pH not in range
-- Indicates pollutant detected at a concentration lower than the stated detection limit.
NA Indicates not analyzed.
DET Indicates compound was detected.
* Type I organics include the following: all pollutants on the original priority pollutant list; all pollutants listed in Appendix C of the modified NRDC/EPA settlement agreement; and the six compounds previously identified by EPA as not susceptible to treatment in a publicly owned treatment works (POTW), or that interfere with, pass through, or are otherwise incompatible with a POTW.

Type II organics include all other pollutants on the 1987 Industrial Technoology Division List of Analytes that can be analyzed for using the approved gas chromatograph/mass spectrometer (GC/MS) methodologies.

treated and discharged each week. The plant wastewater treatment system consists of four 5,000-gallon collection and/or treatment tanks. The wastewater flow discharge, including process water, cooling water, and sanitary, totals approximately 22,000 gpd. The normal procedure for treatment involves the following steps:

1. Collect 3,500 gallons of wastewater in the first tank.

2. Pump the collected wastewater into the second tank.

3. Add 150 pounds of aluminum sulfate and agitate for approximately 30 minutes.

4. Add 10 gallons of caustic and agitate for approximately 30 minutes.

5. Let the solution settle overnight.

6. Pump about 400 gallons into the final tank.

7. Add 4,000 gallons of tap water; mix and sample prior to discharge.

8. This process (6 and 7) is repeated until all the settled wastewater is discharged to the sewer.

The generated sludge from the second tank is pumped to a sludge holding tank before being transferred to a truck for hauling. The sludge is hauled to a waste management facility, where it is dehydrated and transferred to an appropriate landfill.

At the time of the sampling event, wastewater generation was low. Thus, obtaining a full batch of wastewater for treatment resulted in a more diluted batch than normal. Treatment consisted of adding caustic and aluminum sulfate to the batch of wastewater and allowing it to settle overnight. Prior to discharging to the sanitary sewer, approximately 900 gallons of treated wastewater was transferred to another tank and diluted with water at a ratio of 4 to 1 (instead of the normal ratio of 10 to 1). Samples were collected prior to discharge to check for pH and suspended solids.

The major source of wastewater is from the rinsing of mixing tanks and filling equipment. Additional wastewater is generated by floor and spill cleaning, and laboratory and plant sinks. The wastewater is collected in a 5,000-gallon tank for treatment. Solid waste is generated as sludge from the flocculation treatment.

Samples were collected at four locations: a 5,000-gallon holding tank containing raw wastewater; a 5,000-gallon treatment tank containing treated wastewater; a 5,000-gallon tank containing diluted treated wastewater; and the sludge discharge from the 5,000-gallon settling tank. Sample points are indicated in Figure 5-2, and test data are summarized in Table 5-3.

Paint Plant C. The products from Plant C are 100 percent solvent-base paints and varnishes. This plant operates thirteen hours per day, five days per week. No wastewater is generated at this plant, with the exception of sanitary waste. Sludge is generated at this plant from waste solvents. Treatment involves a steam distillation system which yields solvents for reuse.

Sludge samples were collected at the discharge outlet from the steam distillation system. The sludge discharges at a temperature of 210°F. Approximately four 55-gallon drums of sludge are generated daily. A diagram of the plant's distillation system is shown in Figure 5-3. Table 5-4 summarizes test results from on-site sampling at Plant C.

Paint Plant D. Plant D operates a batch-formulating system 24 hours per day, three shifts per day, five days per week. Total yearly paint production is approximately 6 million gallons; approximately 35 percent is water-base paint, and approximately 65 percent is solvent-base paint. The wastewater treatment system consists of four 6,300-gallon collection and/or treatment tanks.

Wastewater is generated from tank and equipment washing. White wash water (i.e, wash water generated from the cleaning of certain white paint formulation tanks) is stored in one of four 6,300-gallon treatment tanks located in the waste treatment room. Approximately 5,000 gallons of wastewater are generated weekly. When enough wastewater is collected to fill the treatment tank, it is treated with aluminum sulfate and allowed to settle for 24 hours. After treatment the supernatant is pumped to a second 6,300-gallon treatment tank, and is used as make-up water for caustic wash solution. The sludge generated from treatment is pumped to a third 6,300-gallon treatment tank. The sludge, although not considered a hazardous waste, is hauled to a hazardous waste landfill. A fourth 6,300-gallon treatment tank is available for wastewater collection if extra capacity is needed. The facility does not discharge any process wastewater to the sanitary sewer. The caustic wash is used until it becomes ineffective. The spent caustic is contained in 250-gallon tote tanks until it can be pumped into a hazardous waste tanker truck and hauled off-site to a hazardous waste landfill. Approximately 118,000 gallons of spent caustic and 170,000 gallons of sludge are generated yearly. Waste solvent generated from solvent tank washing is collected in a 6,000-gallon, spent solvent storage tank located outside the waste treatment room. The facility has a solvent distillation unit on-site; however, it was not operating during the sampling visit. The solvent distillation system is expected to restart operations sometime soon. At the present time, solvent waste is collected and sent off-site for reclamation.

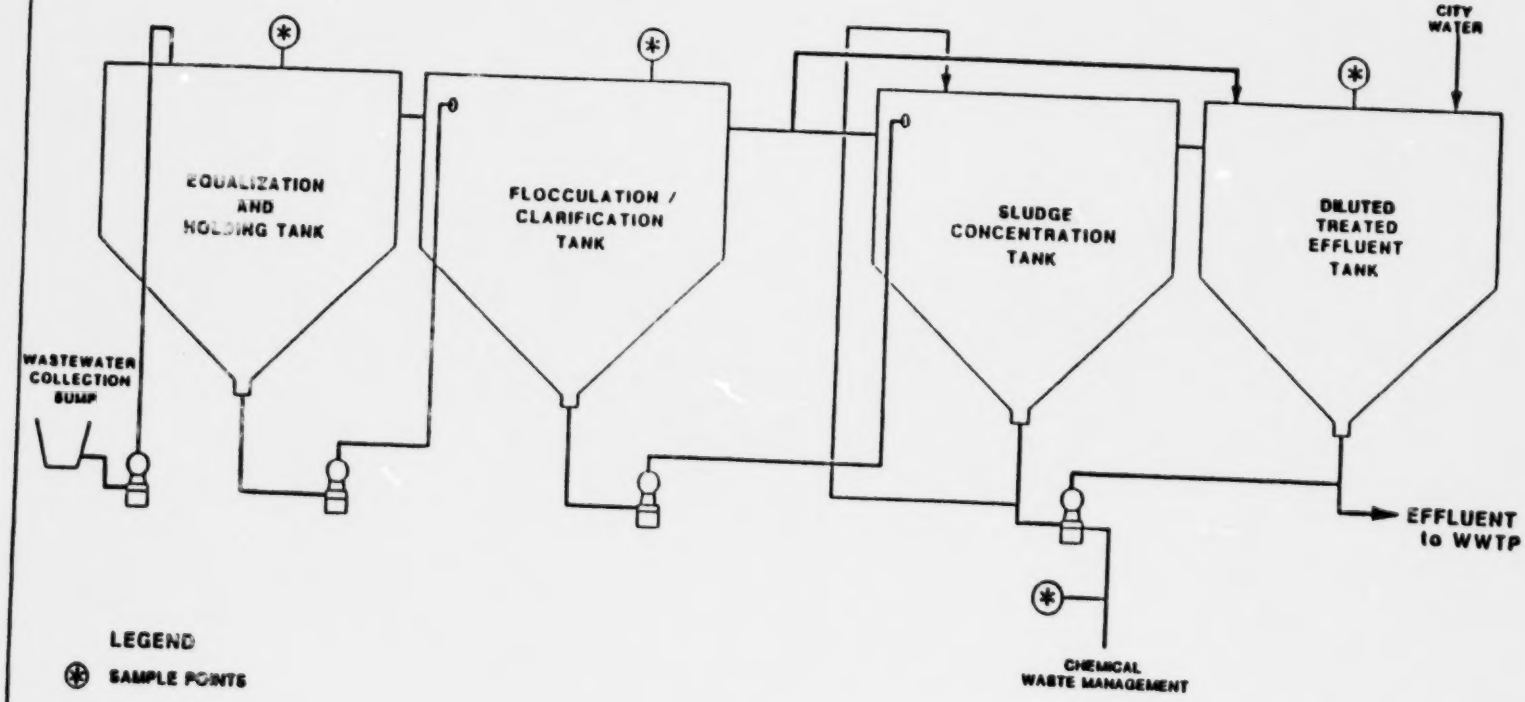


FIGURE 5-2
WASTEWATER TREATMENT SYSTEM
PAINT PLANT B

TABLE 5-3
SUMMARY OF ANALYTICAL RESULTS
PAINT PLANT B

Pollutant Category and Pollutant	Raw Waste (Liquid) µg/ℓ	Treated Waste (Liquid) µg/ℓ	Treated* and Diluted Waste (Liquid) µg/ℓ	(Sludge) µg/kg	TCLP Extract (Sludge) µg/ℓ
Type 1 Organics					
acetone	--	1,523	136	363	141
alpha-terpineol	1,028	2,046	--	283	23
diphenylamine	15,338	--	--	--	--
methylene chloride	--	--	--	60	1,415
n-decane	12,069	--	--	166	22
n-dodecane	7,642	--	--	--	--
n-eicosane	3,857	--	--	--	--
n-octadecane	4,621	1,168	20	34	11
n-tetradecane	--	--	16	--	--
n-triacontane	--	--	--	191	49
naphthalene	8,053	--	--	43	12
2-chloronaphthalene	8,120	5,515	--	--	--
Type 2 Organics					
isobutyl alcohol	--	--	--	117	--
Pesticides/Herbicides					
chlordane	NA	12.50	--	NA	NA
Purgeable Organic Compounds (TVO)	130,000	7,600	310	160,000	NA
Dioxins/Furans					
Not Detected	NA	NA	NA	ND	NA

* Not used in data Avg. Diluted. Not representative
-- Tested less than detection limit

TABLE 5-3 (continued)

Pollutant Category and Pollutant	Raw Waste (Liquid) µg/ℓ	Treated Waste (Liquid) µg/ℓ	Treated and Diluted Waste (Liquid) µg/ℓ	Dry (Sludge) mg/kg	TCLP Extract (Sludge) µg/ℓ
Metals					
calcium	270,000	20,000	32,000	7,870	117,000
magnesium	31,000	2,100	9,200	2,640	7,060
sodium	83,000	1,000,000	72,000	7,400	1,460,000
aluminum	230,000	33,000	2,600	21,000	25,800
manganese	9,100	140	13	622	1,310
lead	53	--	--	--	--
vanadium	190	38	3	--	--
boron	87	100	23	--	1,040
barium	2,300	20	40	373	747
beryllium	3	--	--	--	--
cadmium	--	--	--	--	--
molybdenum	15	28	--	78	--
tin	250	--	--	--	--
yttrium	25	--	--	--	--
cobalt	31	5	--	--	--
chromium	110	6	--	31	--
copper	320	97	8	23	--
iron	140,000	2,900	290	40,300	--
nickel	110	23	--	25	60
titanium	8,900	63	21	1,060	--
zinc	3,400	130	13	169	1,460
arsenic	83	14	--	--	--
antimony	--	33	--	--	--
mercury	--	--	--	0.44	--
Elements					
erbium	DET	--	--	DET	NA
germanium	DET	--	--	--	NA
iodine	DET	--	--	--	NA
potassium	DET	DET	--	--	NA
phosphorus	DET	DET	--	--	NA

-- Less than detection limit

TABLE 5-3 (continued)

Pollutant Category and Pollutant	Raw Waste (Liquid) mg/ℓ	Treated Waste (Liquid) mg/ℓ	Treated and Diluted Waste (Liquid) mg/ℓ	(Sludge) mg/kg	TCLP Extract (Sludge) µg/ℓ
strontium	DET	ND	ND	ND	NA
thallium	DET	ND	ND	ND	NA
tungsten	DET	ND	ND	ND	NA
Conventional Pollutants					
BOD 5-day (carbonaceous)	>4,000b	>4,100b	430	NA	NA
oil and grease, total recoverable	330	69	--	NA	NA
pH, soil	NA	NA	NA	7.1	NA
residue, non-filterable	32,000	330	21	NA	NA
Non-conventional Pollutants					
residue, filterable	22,000	4,400	440	NA	NA
fluoride	--	0.35	1.0	NA	NA
ammonia, as N	25	24	1.4	190	NA
nitrogen, Kjeldahl, total	94	81	8.8	--	NA
nitrate-nitrite, as N	0.27	0.63	0.29	30	NA
total phosphorus, as P	--	--	0.14	NA	NA
chemical oxygen demand	32,000	14,000	980	NA	NA
total organic carbon	5,900	2,800	160	NA	NA
sulfide, total (iodometric)	1.4	4.7	2.1	NA	NA
flash point (°C)	NA	NA	NA	55	NA
residue, total (%)	NA	NA	NA	35	NA
residue, total volatile (%)	NA	NA	NA	33	NA

-- Indicates pollutant at a concentration lower than the stated detection limit.
NA Indicates not analyzed.
b BOD calculated from limiting value.
DET Indicates compound was detected.

TABLE 5-4
SUMMARY OF REPORTED ANALYTICAL RESULTS
PAINT PLANT C

Pollutant Category and Pollutant	Dry Sludge (μg/kg)	TCLP Extract (μg/ℓ)
Type 1 Organics		
acetone	--	597
chlorobenzene	97	--
ethyl benzene	1,503	122
toluene	10,013	100
trichloroethene	110	--
1,1,1-trichloroethane	4,027	--
2-Butanone (MEK)	235,287	18,941
Type 2 Organics		
isobutyl alcohol	2,560	--
Pesticides/Herbicides		
Not Analyzed For		
Purgeable Organic Compounds (TVO)	330,000	NA
Not Analyzed For		
Dioxins/Furans (ng/kg)		
2,3,7,8-TCDD	12.71	NA

TABLE 5-4
(continued)

Pollutant Category and Pollutant	Sludge (mg/kg)	TCLP Extract (μg/ℓ)
Metals		
calcium	45,400	41,600
magnesium	8,230	2,080
sodium	2,800	1,530,000
aluminum	4,400	279
manganese	594	1,840
lead	152	--
boron	--	368
barium	1,960	1,780
cadmium	7	--
molybdenum	121	--
tin	1,370	--
cobalt	886	1,650
chromium	3,590	830
copper	338	188
iron	31,100	--
nickel	28	69
titanium	168	--
zinc	6,100	6,960
mercury	0.56	--
Elements		
sulfur	DET	NA
Conventional Pollutants		
Total Residue - %	30	
pH, soil	6.8	NA
Non-conventional Pollutants		
ammonia, as N	110	NA
nitrogen, Kjeldahl, total	4,700	NA
nitrate-nitrite, as N	240	NA
flash point (°C)	51	NA
residue, total (%)	30	NA
residue, total volatile (%)	15	NA
sulfide, total (Monier-Williams)	12	NA
corrosivity	<10	

NA Indicates not analyzed.
-- Indicates that pollutant detected at a concentration lower than the stated concentration limit.
DET Indicates that pollutant concentration qualitatively detected.

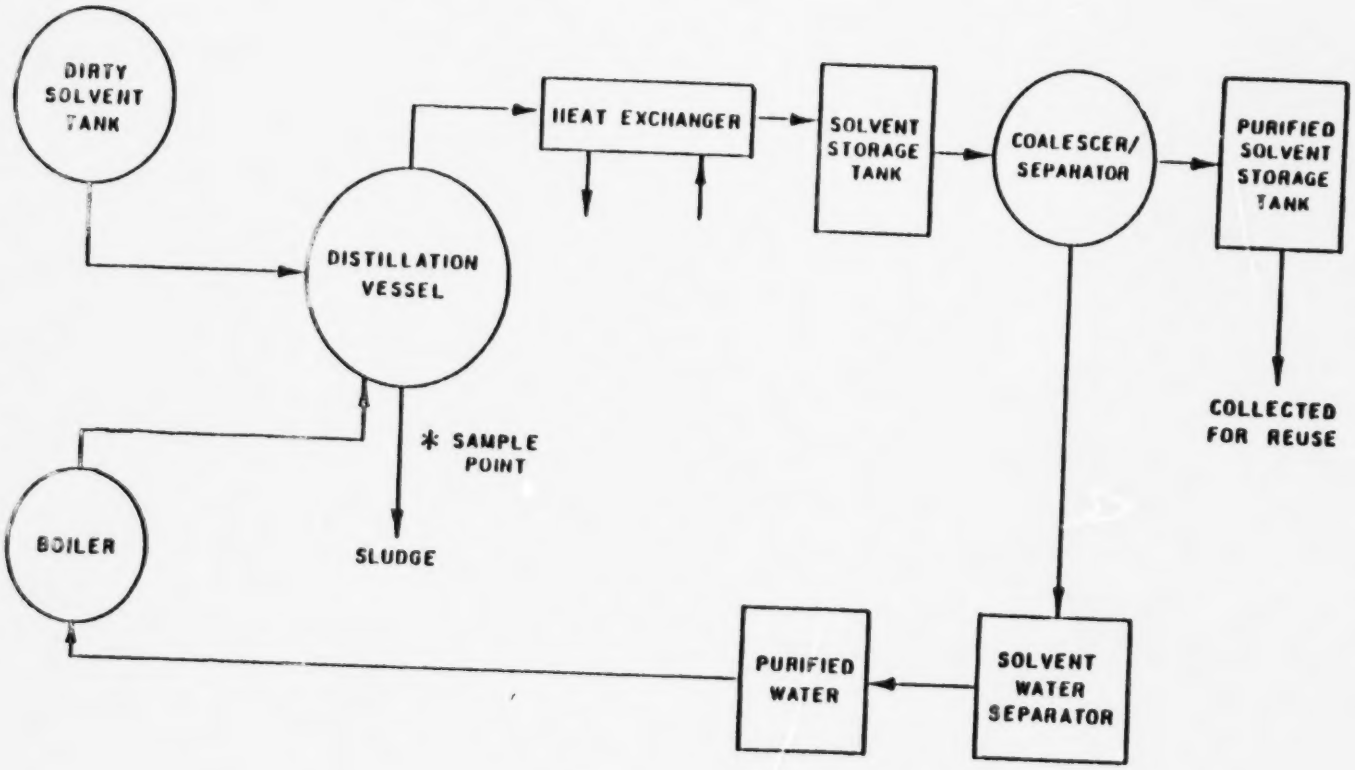


FIGURE 5-3
SOLVENT PURIFICATION
PAINT PLANT C

The resin-formulating operation is essentially separate from the paint formulating operation. A 6,000-gallon, organic storage blending tank contains waste solvent and resin waste from the resin operation. Some solvent-base paint waste is added to this tank; the mixture is then sent out for use in a fuel-blending program. Grab samples were collected from six locations: city water from a tap in the laboratory; a 6,300-gallon treatment tank containing raw wastewater; a 6,000-gallon storage tank containing spent solvent; a 6,300-gallon treatment tank containing supernatant; a 250-gallon tote tank containing spent caustic; and a 6,300-gallon treatment tank containing sludge (generated from wastewater treatment). Sample points are indicated in Figure 5-4, and test results are summarized in Table 5-5.

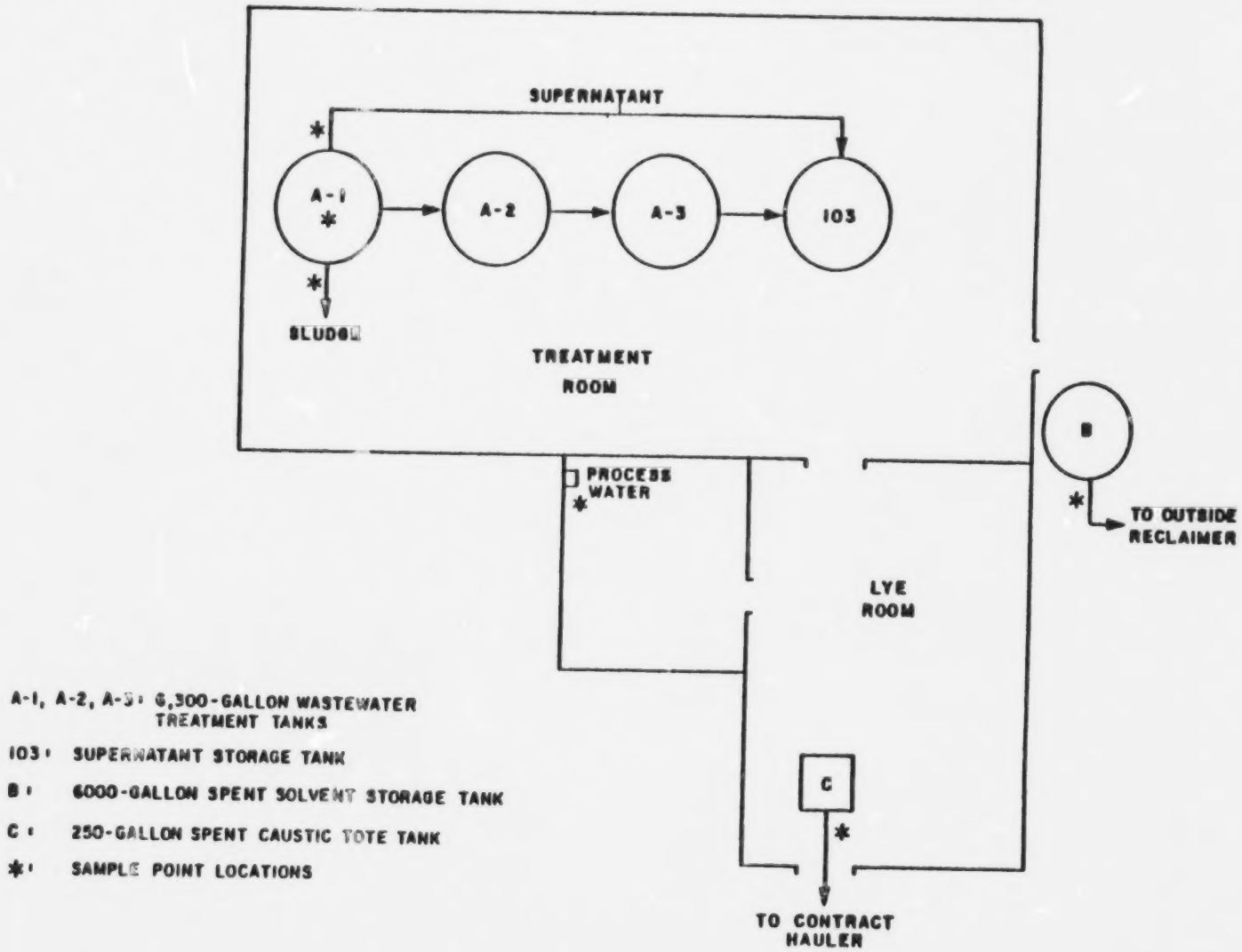


FIGURE 5-4
SAMPLE POINT SCHEMATIC
PAINT PLANT D

TABLE 5-5
SUMMARY OF ANALYTICAL RESULTS
PAINT PLANT D

Pollutant Category and Pollutant	Tap Water (Liquid) µg/ℓ	Raw Waste (Liquid) µg/ℓ	Treated Waste (Liquid) µg/ℓ	Spent Solvent (Liquid) µg/ℓ	Spent Caustic (Liquid) µg/ℓ	Dry (Sludge) µg/kg	TCLP Extract (Sludge) µg/ℓ
Type 1 Organics							
acetone	--	1,926,380	743,410	8,187,200	12,840,400	7,617,357	17,548,900
acrolein	--	--	--	--	--	42,460	5,943
benzene	--	--	--	--	--	--	103
bis(2-ethylhexyl) phthalate	--	--	--	61,241	--	--	--
chlorobenzene	--	--	--	153,424	--	--	--
chloroform	--	--	--	13,661	--	--	--
di-n-butylphthalate	--	--	--	--	--	33,736	--
ethyl benzene	--	119,186	--	3,601,700	34,077	129,336	15,553
isophorone	24	3,090	2,742	--	3,289	25,979	2,786
methylene chloride	--	--	1,110	113,782	--	7,929	--
naphthalene	--	4,696	--	--	7,395	88,136	--
p-cymene	--	--	--	--	2,262	--	--
tetrachloroethene	--	1,092	246	--	--	--	--
toluene	--	100,793	--	6,309,100	293,580	606,300	66,723
trichlorethene	--	373	--	--	--	--	--
1,1 dichloroethene	--	--	--	73,105	--	--	--
1,1,1 trichloroethane	--	1,444	946	295,520	1,261	7,914	880
2-butanone	--	--	583,400	--	1,811,550	6,061,071	1,318,660
3,3'-dichlorobenzidine	--	--	--	--	--	374,357	--
Type 2 Organics							
vinyl acetate	--	--	--	--	--	--	3,653
Pesticides/Herbicides	--	--	--	--	--	--	--

TABLE 5-5
(continued)

Pollutant Category and Pollutant	Tap Water (Liquid) mg/ℓ	Raw Waste (Liquid) mg/ℓ	Treated Waste (Liquid) mg/ℓ	Spent Solvent (Liquid) mg/ℓ	Spent Caustic (Liquid) mg/ℓ	Dry (Sludge) mg/kg	TCLP Extract (Sludge) µg/ℓ
Elements							
indium	--	--	--	1	--	--	NA
iodine	--	--	--	6	5	--	NA
lanthanum	--	0.1	--	0.1	--	--	NA
lithium	--	0.1	--	0.2	0.1	--	NA
lutetium	--	--	--	0.1	--	--	NA
neodymium	--	0.5	--	0.6	--	--	NA
osmium	--	--	--	--	300	--	NA
phosphorus	--	7	1	12	--	196	NA
platinum	--	--	--	--	12	--	NA
potassium	--	5	5	2	16	--	NA
ruthenium	--	--	--	--	2	--	NA
samarium	--	--	--	--	1	--	NA
silicon	4	50	4	3	--	106	NA
strontium	--	4	1	10	1,180	21	NA
sulfur	5	126	1,020	38	--	1,700	NA
thorium	--	--	--	--	0.8	--	NA
zirconium	--	0.3	--	10	--	11	NA

TABLE 5-5
(continued)

Pollutant Category and Pollutant	Tap Water (Liquid) µg/ℓ	Raw Waste (Liquid) µg/ℓ	Treated Waste (Liquid) µg/ℓ	Spent Solvent (Liquid) µg/ℓ	Spent Caustic (Liquid) µg/ℓ	(Sludge) mg/kg	TCLP Extract (Sludge) µg/ℓ
Metals							
calcium	12,700	1,790,000	533,000	2,880,000	161,000	20,100	273,000
magnesium	1,910	21,800	6,610	136,000	4,570	535	4,440
sodium	6,410	921,000	1,120,000	43,400	6,360,000	5,940	760,000
aluminum	--	135,000	10,100	292,000	48,600	10,300	29,700
manganese	--	795	345	3,710	348	28	120
lead	--	1,830	--	426,000	434,000	114	248
vanadium	--	74	--	107	90	--	--
boron	--	1,400	1,640	788	10,300	--	178
barium	--	3,780	103	29,100	1,740	221	496
beryllium	--	--	--	7	--	--	--
cadmium	--	217	62	74	11	3	25*
tin	--	481	--	2,980	699	41	40*
cobalt	--	1,670	791	17,900	1,110	20	167
chromium	--	822	648	176,000	13,400	28	118
copper	62	313	52	745	711	38	61
iron	53	14,400	118	762,000	10,300	1,630	3,280
nickel	--	--	--	694	--	--	--
titanium	--	2,970	--	9,130	889	278	490
zinc	--	843,000	174,000	1,120,000	131,000	7,160	144,000
silver	--	--	--	55	--	--	--
antimony	--	--	--	4,390	1,690	--	--
mercury	--	3,500	232	159	432	67	80

TABLE 5-5
(continued)

Pollutant Category and Pollutant	Tap Water (Liquid) mg/ℓ	Raw Waste (Liquid) mg/ℓ	Treated Waste (Liquid) mg/ℓ	Spent Solvent (Liquid) mg/ℓ	Spent Caustic (Liquid) mg/ℓ	Dry (Sludge) mg/kg	TCLP Extract (Sludge) µg/ℓ
Conventional Pollutants							
BOD 5-Day (carbonaceous)	NA	16,000	9,900	NA	*	NA	NA
oil and grease, total recoverable	NA	560	94	NA	240	NA	NA
pH, soil	NA	NA	NA	NA	NA	6.8	NA
residue, non-filterable	NA	38,000	960	NA	1,900	NA	NA
Non-conventional Pollutants							
residue, filterable	NA	2,500	6,800	NA	31,000	NA	NA
cyanide, total	NA	0.11	NR	NA	0.077	56	NA
fluoride	NA	NR	--	NA	3.2	NA	NA
ammonia, as N	NA	63	69	NA	34	140	NA
nitrogen, Kjeldahl, total	NA	370	15	NA	18	--	NA
nitrate-nitrite, as N	NA	1.3	1.7	NA	4.7	17	NA
total phosphorus, as P	NA	0.61	0.31	NA	1.6	NA	NA
chemical oxygen demand	NA	89,000	42,000	NA	88,000	NA	NA
total organic carbon	NA	11,000	7,300	NA	14,000	NA	NA
sulfide, total (iodometric)	NA	NR	1.9	NA	14	NA	NA
flash point (°C)	NA	NA	NA	NA	NA	30	NA
residue, total (%)	NA	NA	NA	NA	NA	14	NA
residue, total volatile (%)	NA	NA	NA	NA	NA	40	NA
sulfide, total (Monier-Williams)	NA	NA	NA	NA	NA	4.8	NA

\- Indicates pollutant detected at a concentration lower than the stated detection limit.
NA Indicates not analyzed.
* Oxygen depletion exceeded limiting value of 1 mg/ℓ during incubation.
NR No value reported due to severe matrix interferences.

6.0 POLLUTANT PARAMETERS

6.1 Introduction

The purpose of the 1977-1979 study of the paint formulating industry was to determine the presence and amount of toxic pollutants present in paint formulating facility wastewaters. The 1977-1979 study focused on a list of 65 compounds and classes of compounds published in the Consent Decree, which required EPA to consider the need to regulate these compounds during review of BAT Limitations for twenty-one industries. EPA identified 129 specific toxic pollutants (priority pollutants) for study, based on criteria including: toxicity, frequency of occurrence in water, chemical stability and structure, amount of the chemical produced, and the availability of analytical methods. Three of the pollutants on the list, which is known as the Priority Pollutant List, have since been deleted; the remaining 126 priority pollutants are listed in Appendix B.

The study of 12 industries identified in the DSS (including the paint formulating industry) concentrated on a list of pollutants derived from the "ITD/RCRA List of Lists." This List of Analytes (more than 350 compounds) includes all the priority pollutants plus additional compounds. All other pollutants on the List of Analytes can be found in Appendix C. This ITD List of Analytes was derived from the following: over 300 organic pollutants previously identified as pollutants considered toxic, and/or hazardous, by the Office of Solid Waste (RCRA, Appendix VIII), various states (e.g., Michigan and California), the Superfund HSL, the CWA, Appendix C pollutants, Paragraph 4(c) pollutants, VTOX Chemicals, the Priority Pesticides Review List, and the original Priority Pollutant List.

The following rules were used as guidelines for selection of candidate pollutants. All analytes shall be included in the List of Analytes, except:

- analytes that appear on the "Acutely Toxic Chemicals List" only; this list is part of EPA's Chemical Emergency Preparedness Program
- analytes that are hydrolyzed or destroyed by water
- analytes that are designated for analysis by high performance liquid chromatography (HPLC)
- analytes that must be derivatized (except for the phenoxy acid herbicides analyzed by Method 615)
- analytes for which no standard is available
- analytes for which there is no analysis type

6.2 Pollutant Categories

Tables 6-1 and 6-2 present data summaries of pollutants found in raw and treated wastewater. The pollutants are separated into two categories: priority pollutants and non-priority pollutants. Each category is divided into the following subcategories: volatiles, semivolatile, pesticides and herbicides, metals, conventionals and non-conventionals.

The data summary tables are set up to include for each compound, the total number of samples collected, total number detected above the detection limit, concentration range, average concentration, and median concentration. The average concentration is based only on concentrations detected above the specific detection limit for that compound. For specific concentrations of all pollutants detected at each plant, see Tables 5-2, 5-3, 5-4, and 5-5.

6.2.1 Organic Pollutants

A total of 22 volatile or semivolatile organic compounds were found at above detection limit levels in wastewater samples collected at four paint formulating plants in 1986 and 1987. Twelve of these compounds are organic compounds on the 1977 Priority Pollutant List. Table 6-1 presents information on these pollutants. The remaining 10 organic compounds found are on the 1987 List of Analytes. These 10 compounds were not analyzed for in earlier sampling and analysis programs. Table 6-2 presents information on these pollutants.

6.2.2 Metals

The metals found in the highest concentrations were aluminum, calcium, iron, magnesium, sodium, and zinc in both wastewater and sludge. A total of eleven metals on the 1977 Priority Pollutant List were found in the raw wastewater samples at quantifiable levels. Fourteen non-priority metals were also detected in the raw wastewater samples. Concentrations were generally significantly reduced in the treated effluent except for sodium, cobalt, boron, and chromium.

Metals found present in the highest quantities in the wastewater were calcium, sodium, zinc, aluminum and iron. Only zinc is on the priority pollutant list.

6.2.3 Pesticides/Herbicides

Three of these compounds were detected. Priority pollutants chlordane and aldrin were found at low concentrations in the treated wastewater, but not in raw wastewater. The aldrin was found only in a sample of a diluted wastewater stream judged as non-representative of the particular plant and is referenced only. Phosmet was determined only in one plant'raw wastewater, but not in the treated wastewater. No other pesticides/herbicides were detected.

TABLE 6-1
DATA SUMMARY
1986/1987 SAMPLING PROGRAM
PRIORITY POLLUTANTS

POLLUTANT CATEGORY/ POLLUTANT	RAW WASTEWATER					TREATED WASTEWATER				
	NUMBER OF SAMPLES ANALYZED	NUMBER OF DETECTIONS	RANGE (µg/ℓ)	AVERAGE CONCENTRATION (µg/ℓ)	MEDIAN (µg/ℓ)	NUMBER OF SAMPLES ANALYZED	NUMBER OF DETECTIONS	RANGE (µg/ℓ)	AVERAGE CONCENTRATION (µg/ℓ)	MEDIAN (µg/ℓ)
Volatiles										
1. 1,1-Dichloroethane	4	1	ND-313	313	--	5	1	ND-306	306	--
2. Ethyl Benzene	4	1	ND-119,186	119,186	--	5	0	ND	ND	ND
3. Methylene Chloride	4	1	ND-136	136	--	5	2	ND-1,110	734	734
4. Tetrachloroethene	4	1	ND-1,092	1,092	--	5	1	ND-246	246	--
5. Toluene	4	1	ND-100,793	100,793	--	5	0	ND	ND	ND
6. 1,1,1-Trichloroethane	4	2	ND-1,444	1,337	1,337	5	2	ND-946	764	764
7. Trichloroethene	4	1	ND-373	373	--	5	0	ND	ND	ND
Semivolatiles										
8. Benzidine	4	1	ND-5,233	5,233	--	5	0	ND	ND	ND
9. 2-Chloronapthalene	4	2	ND-8,120	8,120	--	5	1	ND-5,515	5,515	--
10. 2,6-Dinitrotoluene	4	0	ND	ND	ND	5	1	ND-3,917	3,917	--
11. Isophorone	4	1	ND-3,090	3,090	--	5	1	ND-2,742	2,742	--
12. Naphthalene	4	2	ND-8,053	6,375	6,375	5	0	ND	ND	ND
Pesticides/Herbicides										
13. Chlordane	4	0	ND	ND	ND	5	1	ND-12.5	12.5	--
14. Aldrin	4	0	ND	ND	ND	5	1	ND-0.6	0.6	--
Metals										
15. Antimony	4	2	ND-831	191	191	5	4	ND-514	205	137
16. Arsenic	4	1	ND-83	83	--	5	1	ND-14	14	--

TABLE 6-1
(continued)

POLLUTANT CATEGORY/ POLLUTANT	RAW WASTEWATER					TREATED WASTEWATER				
	NUMBER OF SAMPLES ANALYZED	NUMBER OF DETECTIONS	RANGE (μg/ℓ)	AVERAGE CONCENTRATION (μg/ℓ)	MEDIAN (μg/ℓ)	NUMBER OF SAMPLES ANALYZED	NUMBER OF DETECTIONS	RANGE (μg/ℓ)	AVERAGE CONCENTRATION (μg/ℓ)	MEDIAN (μg/ℓ)
Metals (continued)										
17. Beryllium	4	2	ND-3	2.9	2.9	5	0	ND	ND	ND
18. Cadmium	4	2	ND-217	119	119	5	1	ND-62	62	--
19. Chromium	4	4	82-822	311	169	5	2	ND-648	327	327
20. Copper	4	4	167-320	263	282	5	2	ND-97	75	75
21. Lead	4	4	53-1,830	538	134	5	0	ND	ND	ND
22. Mercury	4	1	ND-3,500	3,500	--	5	1	ND-232	232	--
23. Nickel	4	3	ND-126	96	110	5	1	ND-23	23	--
24. Silver	4	1	ND-2.7	2.7	--	5	0	ND	ND	ND
25. Zinc	4	4	3,400-843,000	253,175	83,150	5	5	130-174,000	37,382	5,810
Non-Conventionals										
26. Total Cyanide	4	1	ND-110	110	--	5	0	ND	ND	ND

TABLE 6-2
DATA SUMMARY
1986/1987 SAMPLING PROGRAM
NON-PRIORITY POLLUTANTS

POLLUTANT CATEGORY/ POLLUTANT	RAW WASTEWATER					TREATED WASTEWATER				
	NUMBER OF SAMPLES ANALYZED	NUMBER OF DETECTIONS	RANGE (µg/ℓ)	AVERAGE CONCENTRATION (µg/ℓ)	MEDIAN (µg/ℓ)	NUMBER OF SAMPLES ANALYZED	NUMBER OF DETECTIONS	RANGE (µg/ℓ)	AVERAGE CONCENTRATION (µg/ℓ)	MEDIAN (µg/ℓ)
Volatiles										
1. Acetone	4	1	ND-1,926,380	1,926,380	--	5	4	ND-743,410	186,596	1,129
2. 2-Butanone	4	0	ND	ND	ND	5	1	ND-583,400	583,400	--
Semivolatiles										
3. Alpha-Terpineol	4	1	ND-1,028	1,028	--	5	2	ND-5,169	3,608	3,608
4. Diphenylamine	4	1	ND-15,338	15,338	--	5	0	ND	ND	ND
5. n-Decane	4	1	ND-12,069	12,069	--	5	0	ND	ND	ND
6. n-Dodecane	4	1	ND-7,642	7,642	--	5	0	ND	ND	ND
7. n-Eicosane	4	1	ND-3,857	3,857	--	5	0	ND	ND	ND
8. n-Octacosane	4	1	ND-5,133	5,133	--	5	0	ND	ND	ND
9. n-Octadecane	4	1	ND-4,621	4,621	--	5	1	ND-1,168	1,168	--
10. n-Tetracosane	4	1	ND-6,919	6,919	--	5	0	ND	ND	ND
Pesticides/Herbicides										
11. Phosmet	4	1	ND-18	18	--	5	0	ND	ND	ND
Metals										
12. Aluminum	4	4	135,000-424,000	231,750	184,000	5	5	806-33,000	9,311	1,790
13. Barium	4	4	1,720-3,780	2,658	2,565	5	5	20-271	120	103
14. Boron	4	4	87-1,400	439	134	5	5	100-1,640	450	155

TABLE 6-2
(continued)

POLLUTANT CATEGORY/ POLLUTANT	RAW WASTEWATER					TREATED WASTEWATER				
	NUMBER OF SAMPLES ANALYZED	NUMBER OF DETECTIONS	RANGE (µg/ℓ)	AVERAGE CONCENTRATION (µg/ℓ)	MEDIAN (µg/ℓ)	NUMBER OF SAMPLES ANALYZED	NUMBER OF DETECTIONS	RANGE (µg/ℓ)	AVERAGE CONCENTRATION (µg/ℓ)	MEDIAN (µg/ℓ)
15. Calcium	4	4	224,000-1,790,000	785,000	564,000	5	5	20,000-533,000	173,800	108,000
16. Cobalt	4	4	5.3-1,670	446	54	5	2	ND-791	398	398
17. Iron	4	4	14,400-1,950,000	120,350	136,000	5	5	74-2,900	702	118
18. Magnesium	4	4	21,800-49,000	35,700	36,000	5	5	2,100-36,000	21,142	30,000
19. Manganese	4	4	795-9100	3,511	2,220	5	5	140-345	224	224
20. Molybdenum	4	2	ND-16	16	16	5	1	ND-28	28	--
21. Sodium	4	4	83,000-921,000	299,500	97,000	5	5	198,000-1,112,000	611,600	383,000
22. Tin	4	4	250-554	418	434	5	0	ND	ND	ND
23. Titanium	4	4	2,000-8,900	4,630	3,810	5	2	ND-63	37	37
24. Vanadium	4	4	74-299	173	159	5	3	ND-38	22	26
25. Yttrium	4	2	ND-41	33	33	5	0	ND	ND	ND
Conventionals										
26. BOD	4	4	1,700,000-16,000,000	6,925,000	5,000,000	5	5	1,500,000-9,900,000	4,460,,000	3,400,000
27. TSS	4	4	20,000,000-38,000,000	30,750,000	32,500,000	5	5	40,000-960,000	290,600	76,000
Non-Conventionals										
28. Ammonia, as N	4	4	16,000-63,000	32,000	24,500	5	5	14,000-69,000	33,600	30,000
29. Fluoride	3	2	ND-320	300	300	5	4	ND-350	231	270
30. COD	4	4	17,000,000-89,000,000	43,000,000	37,000,000	5	5	3,600,000-42,000,000	14,700,000	7,100,000

6.2.4 Conventional Pollutants

BOD5 and TSS were analyzed for at each raw or treated waste sampling point. They were found at high concentrations as shown in Table 6-2. As expected in these plants, where treatment essentially consists only of gravity clarification, moderate BOD5 reduction occurred (57 percent), but TSS was reduced by nearly 99%. With the small flows and long settling times, good clarification was achieved.

BOD5 concentrations average 6,925 mg/l in the raw waste and 4,460 mg/l in the treated effluent. TSS values were 30,750 mg/l raw waste and 291 mg/l in the treated effluent.

6.2.5 Non-conventional Pollutants

The following non-conventional pollutants were quantified: ammonia (as N), fluoride, COD, nitrate-nitrite, Kjeldahl nitrogen, filterable residue, sulfide (M-W), and total phosphorus. Cyanide was detected in the raw wastewater of plant D at a concentration of 110 µg/l.

Ammonia was detected in all raw and treated waste samples and was essentially unchanged between raw and final waste streams. Similar observations are made in the case of the Kjeldahl nitrogen and nitrate-nitrite parameters.

Fluoride levels were reduced slightly during clarification, and were present in all but one sampling episode. The COD concentrations of all raw and treated wastewater samples were analogous to the observed BOD5 raw and treated wastewater concentrations, indicating treatment caused reduction. Filterable residue was reduced by nearly 67% by treatment, paralleling the TSS reduction, but from overall lower levels.

Phosphorus was detected in only one wastewater sample, and in four of five final effluent samples. Sulfide was detected in one raw and three treated wastewater samples.

6.2.6 Sludge - Pollutant Parameters

A data summary for sludge samples is presented in Table 6-3. The pollutants are separated into the following categories: volatiles, semivolatiles, metals, purgeable organic compounds, conventional pollutants, and non-conventional pollutants. Sludge samples from each paint formulating facility sampled were analyzed for the same compounds as wastewater samples.

Guideline procedures for determining if a solid waste has the characteristics of a hazardous waste are presented in 40 CFR 261 Subpart C. The guidelines discuss the characteristics of ignitability, corrosivity, and EP toxicity.

TABLE 6-2
(continued)

POLLUTANT CATEGORY/ POLLUTANT	RAW WASTEWATER					TREATED WASTEWATER				
	NUMBER OF SAMPLES ANALYZED	NUMBER OF DETECTIONS	RANGE (μg/ℓ)	AVERAGE CONCENTRATION (μg/ℓ)	MEDIAN (μg/ℓ)	NUMBER OF SAMPLES ANALYZED	NUMBER OF DETECTIONS	RANGE (μg/ℓ)	AVERAGE CONCENTRATION (μg/ℓ)	MEDIAN (μg/ℓ)
31. Nitrate-nitrite, as N	4	4	140-1,300	463	205	5	5	50-1,700	636	420
32. Nitrogen, Kjeldahl, Total	4	4	44,000-370,000	157	107	5	5	8,800-83,000	60,400	81,000
33. Residue, Filterable	4	4	2,500,000-22,000,000	9,525,000	6,800,000	5	5	440,000-6,800,000	3,540,000	2,400,000
34. Sulfide (iodometric)	2	1	NR-1,400	1,400	--	3	3	1,900-4,700	2,900	2,100
35. Total Phosphorus, as P	4	1	ND-610	610	--	5	4	ND-660	315	230

TABLE 6-3
SUMMARY OF ANALYTICAL RESULTS
FOR WASTEWATER SLUDGE SAMPLES

Pollutant Category and Pollutant	Plant A Solid (Sludge) µg/kg	Plant A TCLP (Extract) µg/ℓ	Plant B Solid (Sludge) µg/kg	Plant B TCLP (Extract) µg/ℓ	Plant C Solid (Sludge) µg/kg	Plant C TCLP (Extract) µg/ℓ	Plant D Solid (Sludge) µg/kg	Plant D TCLP (Extract) µg/ℓ
Volatiles								
acetone	--	--	363	141	--	597	7,617,357	17,548,900
acrolein	--	--	--	--	--	--	42,450	--
benzene	--	--	--	--	--	--	--	103
ethyl benzene	--	13	--	--	1,503	122	129,336	15,553
isobutyl alcohol	--	--	117	--	2,560	--	--	--
methylene chloride	--	--	60	1,415	--	--	7,929	--
tetrachloroethene	26	15	--	--	--	--	--	--
toluene	--	--	--	--	10,013	100	606,300	66,723
vinyl acetate	--	--	--	--	--	--	--	3,653
1,1,1 trichloroethane	--	--	--	--	4,027	--	7,914	--
2-butanone	--	--	--	--	235,287	18,941	6,061,071	1,318,660
Trichloroethene	--	--	--	--	110	--	--	--
Chlorobenzene	--	--	--	--	97	--	--	--
Semivolatiles								
alpha-terpineol	--	--	283	23	--	--	--	--
di-n-butylphthalate	--	--	--	--	--	--	33,736	--
isophorone	--	--	--	--	--	--	25,979	2,786
naphthalene	--	--	43	12	--	--	88,136	--
n-decane	--	--	166	22	--	--	--	--
n-triacontane	--	--	191	49	--	--	--	--
thioxanthone	1,886	--	--	--	--	--	--	--
3,3 dichlorobenzidine	--	--	--	--	--	--	374,357	--
N-octodecane	--	--	34	11	--	--	--	--
Metals								
calcium	17,300	258,000	7,870	117,000	45,000	41,600	20,100	273,000
magnesium	593	6,540	2,640	7,060	8,230	2,080	535	4,440
sodium	941	1,810,000	7,400	1,460,000	2,800	1,530,000	5,940	760,000
aluminum	14,300	13,000	21,000	25,800	4,400	279	10,300	29,700
manganese	118	571	622	1,310	594	1,840	28	120
lead	55	--	--	--	152	--	114	248
vanadium	10	--	--	--	--	365	--	--
boron	19	--	--	1,040	1,960	1,780	--	178
barium	271	1,580	373	747	7	--	221	496
cadmium	4	10	--	--	121	--	3	75*
molybdenum	40	100	78	--	--	--	--	--
tin	45	--	--	--	1,370	--	41	40*
cobalt	10	--	--	--	886	1,650	20	167
chromium	18	--	31	--	3,590	830	28	118
copper	10	--	23	--	338	188	38	61

TABLE 6-3 (continued)

Pollutant Category and Pollutant	Plant A Solid (Sludge) µg/kg	Plant A TCLP (Extract) µg/ℓ	Plant B Solid (Sludge) µg/kg	Plant B TCLP (Extract) µg/ℓ	Plant C Solid (Sludge) µg/kg	Plant C TCLP (Extract) µg/ℓ	Plant D Solid (Sludge) µg/kg	Plant D TCLP (Extract) µg/ℓ
Metals (continued)								
iron	12,600	139	40,300	--	31,100	--	1,630	3,280
nickel	--	63	25	60	28	69	--	--
titanium	446	--	1,060	--	168	--	278	490
zinc	3,030	297,000	169	1,460	6,100	6,960	7,160	144,000
antimony	--	66	--	--	--	--	--	--
mercury	0.14	--	0.44	--	.34	--	67	80
Conventional Pollutants								
pH	7.5	NA	7.1	NA	6.8	NA	6.8	NA
Non-conventional Pollutants								
ammonia, as N	140	NA	190	NA	110	NA	140	NA
cyanide	--	NA	--	NA	NA	NA	56	NA
nitrogen, kjedahl, total	1,100	NA	--	NA	4,700	NA	--	NA
nitrate - nitrite, as N	--	NA	30	NA	240	NA	17	NA
flash point (C)	55	NA	55	NA	510	NA	30	NA
residue, total (%)	57	NA	35	NA	30	NA	14	NA
residue, total volatile (%)	24	NA	33	NA	15	NA	40	NA
sulfide, total	37	NA	NA	NA	12	NA	4.8	NA
Corosivity - MPY	<10	NA	<10	NA	<10	NA	<10	NA
Purgeable Organic Compounds								
	5,400	NA	160	NA	330	NA	NA	NA

-- Indicates pollutant detected at a concentration lower than the stated detection limit.
NA Indicates not analyzed.
* Indicates duplicate analysis is not within control limits.

Nine volatile priority pollutants were detected in either the sludges or their extracts, along with four non-priority volatile, four semivolatile priority and five non-priority semivolatiles pollutants.

Samples from producers of water-base plants, i.e., plants A and B, contained fewer organics at lower concentrations compared with samples from plants C and D, which both produce solvent-base paints. Samples from plant D, which produces both types of paint, contained more organic constituents than any of the other samples.

Metal concentrations were appreciable for all four plants reflecting residues from pigments used in paint manufacturing. Cyanide was detected in only one sample.

The Toxicity Characteristics Leaching Procedure (TCLP) sludge extraction method was used to determine the toxic characteristics of sludges produced at the four plants, per Section 261.24 of 40 CFR Part 261 Hazardous Waste Management System: Identification and Listing of Hazardous Waste (51 FR 21648, June 13, 1986). Sludge samples were leached under precise conditions, and then the leachate (extract) was tested for the compounds listed in Table 1 of the above reference. If leachate concentrations exceed any of the values for compounds in Table 1, then the solid waste is considered to exhibit the characteristics of toxicity and is subject to regulation.

Results from the analyses of the TCLP sludge extract were compared to the list of Regulatory Levels of Contaminants for the Characteristic of EP Toxicity (40 CFR 261.24). None of the concentrations were equal to or above the regulatory levels. Based on these findings, the wastewater sludge extracts analyzed did not have the hazardous waste characteristic of EP toxicity.

Sludge samples were also analyzed for corrosivity; results showed all values for corrosivity to be less than the detection limit (i.e., less than 10 mils per year [mpy]). The pH of the sludge was also measured. Criteria set forth in 40 CFR 261.22 state that a waste is corrosive if its pH is less than or equal to 2, or greater than or equal to 12.5; all results showed pH levels were greater than 2.0 and less than 12.5. Additional criteria state that the corrosivity cannot be greater than 6.35 mm per year (or 0.25 inches per year). Based on these criteria, the wastewater sludges tested do not have the hazardous waste characteristic of corrosivity.

Flash point, the measurement for ignitability, was measured for the actual sludge samples (40 CFR 261.21). The criteria set forth in 261.21 state that a waste exhibits the characteristic of ignitability if it is a liquid containing less than 24 percent alcohol by volume and has a flash point of less than 60°C. Analysis results revealed flash points less than 60°C; therefore,

based on these data, the sludge samples tested do have the characteristic of ignitability.

7.0 CONTROL AND TREATMENT TECHNOLOGY

The paint formulating industry has, in the past 10 years, made significant efforts to reduce the volume of wastewater discharged. Review of current information on the 41 NPDES-permitted direct dischargers, provided by EPA's Office of Water Enforcement and Permits (the "Quick Look Report," April 22, 1986) revealed that none of the permitted plants are allowed to discharge process wastewater directly to the navigable waters of the United States. Allowable water discharges usually include stormwater runoff, noncontact cooling water, and/or boiler blowdown, but not process wastewater. The only paint formulating plants known to be discharging process wastewater do so to municipal wastewater treatment facilities (POTWs). The degree of control and treatment of wastewater practiced by facilities discharging to POTWs, often depends on the requirements established by the municipal system. For example, some municipal systems may monitor influent for conventional pollutants only (e.g., BOD, TSS, pH, oil and grease, and fecal coliform), while others monitor for conventionals and also for metals. Many POTWs require submittal of discharge monitoring reports from the facilities contributing to the POTW influent.

Information on pretreatment requirements was obtained from three municipal treatment systems located near the paint formulating facilities visited during this study. Each of the systems had specific influent limits for conventional pollutants and metals. Specific municipal treatment plant influent limits for the areas visited are presented in Table 7-1. Limits cited in Table 7-1 are those for the actual maximum allowable concentration of paint plant discharge to the sewer, and are based on levels determined by the POTW to be consistent with safe POTW plant operations and POTW discharge limits.

7.1 In-plant Source Control Strategies

Two widely used, general strategies for reducing the amount of wastewater that paint formulating plants discharge to the environment include: (a) reducing the volume of fresh water required, and (b) reusing as much water as possible in plant processes. The amount of wastewater needed to be disposed of is influenced by the water pressure used for tank and equipment cleaning, the degree of cleaning required, and the use, when possible, of dry cleaning techniques.

7.1.1 Wastewater Reduction

The amount of water required to clean a paint tank can be reduced by cleaning the tank walls with a squeegee or rag (when tank size and product type permit) prior to rinsing with water. The use of high pressure water for tank cleaning is also an effective technique for reducing cleaning water requirements. Several

TABLE 7-1

SUMMARY OF MUNICIPAL TREATMENT SYSTEM INFLUENT LIMITATIONS

Pollutant	Atlanta*	Baltimore	Chicago
Metals (mg/ℓ)			
arsenic	1.0	--	--
boron	--	--	1.0
cadmium	1.2	1.3	2.0
chromium (total)	13.0	7.0	25.0
chromium (hexavalent)	1.5	--	10.0
copper	4.5	4.5	3.0
iron	--	--	50.0
lead	0.6	0.7	0.5
mercury	0.05	--	0.0005
nickel	4.0	4.1	10.0
silver	--	1.2	--
zinc	1.0	4.2	15.0
Conventionals			
BOD (mg/ℓ)	--	300	--
Oil & Grease (mg/ℓ)	25	100	100
pH	5.5-12.5	6.0-10.0	4.5-10.0
Non-conventionals			
phenol	15.0	--	--
cyanide (mg/ℓ)	4.0	1.3[1]	10.0[1]
COD (mg/ℓ)	--	500	--
temperature °F	--	150	150
dissolved solids (mg/ℓ)	--	1,500	--
suspended solids (mg/ℓ)	--	400	--
total solids (mg/ℓ)	--	1,900	--

[1] Limits are reported for (total) cyanide.
-- Indicates that no limit exists.
* Wastewater strength limit-at discharger-per City of Atlanta Specific Pollutant Limits - R. Hadden
Baltimore - per Table 22 - "Discharge Limitations" - Memo 7/25/86 M. Zawmm to R.B. Sellars.
Chicago - "Sewage and Waste Control Ordinance" - pg. 20 - Rev. Oct. 1978.

commercial systems are available consisting of booster pumps, flow regulators, and nozzles. These systems supply low-volume, high-pressure water sprays that clean tanks as well or better than hand-held hoses at normal water pressure. High-pressure sprays, if used properly, can clean in a shorter time with less water.

Hand-held wand nozzles and large, fixed, whirling nozzles are available for tank cleaning. The wand nozzles also can be used for other cleaning operations in a paint plant (e.g., filling equipment cleanup). A permanent high-pressure wash system with enough outlets to service the whole production area can be installed at larger paint plants. Portable high-pressure pumps with flexible hoses that can be moved from place to place, can be used at smaller plants.

Another effective in-plant control measure to reduce wastewater is the sealing or elimination of floor drains and trenches (where permitted under fire codes). Because all tank and filling area rinse water must be collected if no drains are available, the operating staff has an incentive to reduce the volume of water used. Spills can be picked up with shovels or squeegees; floors usually are mopped, vacuumed, or cleaned by machine. Where floor drains and trenches exist, the tendency to hose down equipment and floors is greater, thus leading to greater water consumption and wastewater generation.

Additional wastewater reduction methods are as follows:

- use of mechanical devices (e.g., rubber wipers) to scrape the sides of the mixing tanks to reduce the amount of clinging paint (mixing tanks with automatic wall scrapers are now available)

- use of Teflon-lined tanks to reduce adhesion and improve the drainage of paint (this method is especially applicable to small batch tanks that are cleaned manually)

- use of a plastic or foam "pig" to clean pipes (the "pig," forced through the pipe from the mixing tank to the filling machine, pushes paint clinging to walls of the pipe ahead, thereby increasing the yield and reducing the degree of pipe cleaning required)

- scheduling a specific paint production run for as long as possible, or cycling from light to dark colors to reduce the need for equipment cleaning.

All of these methods are currently used at paint formulating plants, more often at the larger facilities. Recovery and reuse of wastewater or spent solvents, resulting in reduced costs, is the most common and beneficial method used for wastewater reduction.

7.1.2 Wastewater Reuse

Some paint plants produce a variety of paint colors and finishes. However, a large number of paint formulators produce base color paints (white and off-white paints) for subsequent tinting. Standard practice at many plants, is to segregate white paint production from other colors and to reuse wastes from each batch in subsequent batches of the same color. Use of the same tank for subsequent batches eliminates the washdown operation after each batch and minimizes the generation of wastewater. This procedure can also be used in isolated cases when a plant produces a large amount of any given color over a short period of time.

Even when plants cannot dedicate tanks to a single product, recycling opportunities result from scheduling batches of similar products back-to-back in the same tank. The rinse water from the first batch remains in the tank and is used in the next batch as part of the formulation, reducing raw material requirements and wastewater volume, and also reducing disposal costs.

When paint plants cannot immediately reuse material in the next batch, recycling methods are available. For example, some plants collect all paint wastewater in drums or tanks, label it by color and base, and reuse it in the next compatible batch (i.e., a similar or darker color). This wastewater may need protection against spoilage, e.g., treatment with a biocide, and is usually used as soon as possible.

7.2 Water Wash Wastestream Treatment and Disposal Practices

The most common wastewater treatment method in the water-base paint formulating segment is physical-chemical (P-C), usually chemical addition and gravity settling for suspended solids control. P-C treatment in the paint formulating industry is a batch operation. The plants collect wastewater in a holding tank until a sufficient quantity is collected for treatment. As necessary, the pH is adjusted to an optimum level; a coagulant (i.e., lime, aluminum sulfate, ferric chloride, or iron salts) and/or a coagulant aid (i.e., polymer) are added and mixed; the batch is then allowed to settle (from 1 to 48 hours). The supernatant is either discharged or reused for tank cleaning until it is spent. Often the sludge remains in the tank during treatment of subsequent batches to allow additional settling and to reduce the frequency of sludge handling prior to disposal. Skins (i.e., coagulated paint product) that float to the surface are usually removed manually and disposed of as a solid waste along with the generated sludge.

According to results of a survey conducted by the NPCA Manufacturing Committee (April 1986), in which 45 paint-formulating plants participated, 33 percent of the facilities discharge equipment wash water to the municipal sewer without treatment; 44 percent recycle the wash water back into the process; 14 percent treat the wash water by flocculation and

settling, and discharge the supernatant to the municipal sewer; and 9 percent treat the wash water by flocculation and settling, and reuse the supernatant in the process. Of the plants that treat with flocculation, 30 percent recycle the settled solids (i.e., sludge) back into the paint-formulating process, and 70 percent dispose of the sludge as a non-hazardous waste. Some paint formulating facilities that generate a small amount of wastewater sludge dispose of it as a hazardous waste along with other hazardous wastes generated on-site (e.g., spent solvent and spent caustic).

7.3 Solvent Wash Wastestream Treatment and Disposal Practices

Pretreatment standards for new sources do not permit the discharge of process wastewater pollutants to municipal wastewater treatment systems. Industry practices in both newer and older plants include reuse of wash solvent until it is spent, reclamation of wash solvent through distillation or settling on or off-site, and disposal of waste solvent by incineration, or off-site use as a fuel supplement.

According to the NPCA survey of 45 paint formulating facilities, 28 percent send wash solvents off-site to a reclaimer for recovery; 18 percent dispose of the wash solvent "as is"; 23 percent reuse wash solvent in the process without treatment; and 31 percent recover wash solvents on-site. Methods for on-site recovery include: 39 percent by vacuum distillation, 39 percent by steam distillation, and 22 percent by settling/decanting. Most of the solvents disposed of "as is", are ultimately burned as a fuel supplement.

ECONOMIC IMPACT ANALYSIS

8.0 INTRODUCTION TO THE ECONOMIC IMPACT STUDY

Sections 8 through 10 of this document present an outline and the results of a study of the economic characteristics of the paint formulating industry. The purpose of the study was to determine the economic health of the industry and the likely economic impact on the industry of governmental regulations on paint formulating wastewater discharge.

8.1 Introduction

This industry profile and preliminary economic impact analysis is divided into three sections:

- Section 8.0 provides an introduction; Section 8.2 provides a brief review of the processes employed by the industry. Section 8.3 describes the number and location of firms and establishments. Section 8.4 discusses employment and wages in the industry. Section 8.5 presents ownership characteristics. Section 8.6 describes products and prices. Section 8.7 discusses financial characteristics. Section 8.8 presents the foreign trade issue. Section 8.9 describes trends in the industry.

- Section 9 presents an economic impact assessment of the industry. Section 9.1 describes the methodology involved. Section 9.2 is a definition of the typical plants. Section 9.3 is the economic impact of compliance costs on profitability.

- Section 10 describes the limits of the analysis. Section 10.1 is a definition of the industry limits. Section 10.2 describes the limits on economic and financial data. Section 10.3 presents regulatory options and compliance costs.

There were approximately 1,450 paint formulating establishments in the United States in 1982, owned by 850 firms, with total employment of approximately 54,000. Total 1985 industry revenues were approximately $9.2 billion.

The paint formulating industry is a very mature industry with predicted annual growth rate of about 2 percent. The number of both companies and plants has been declining and is expected to continue as companies seek to increase sales and provide more resources for R&D efforts through consolidation.

8.2 Industry Profile

For purposes of this analysis, the Paint Formulating Industry is defined to cover all facilities that formulate paint products. While paint formulating processes differ slightly between solvent-based and water-based products, they usually involve three steps:

- mixing and grinding (if necessary) of raw materials
- tinting and thinning
- filling (filtering, packaging and labeling)

Generally, paints and coatings are classified into three categories. Ranked in order of their value of shipments in 1986, the three categories are:

- Architectural Coatings (42 percent of industry shipments). Usually water-based, these are general-purpose paints, varnishes and lacquers used on residential, commercial and industrial structures. Sold through wholesalers and retailers, they are also called trade sales paints.

- Industrial or Product Coatings for Original Equipment Manufactures (37 percent of industry shipments). Usually solvent-based, these are formulated to customer specifications and applied during manufacturing. They are used on durable goods, such as automobiles, appliances furniture and metal containers.

- Special-purpose Coatings (21 percent of industry shipments). Usually solvent-based, they are formulated for special applications or special environmental conditions. Sold by wholesalers and retailers, major markets for these products include automobile and machinery refinishing, bridges, industrial maintenance and traffic markings.

Paint formulating plants tend to specialize in either solvent-based or water-based production. In the case of water-based production, wastewater is generated primarily by the clean-up process. After removing as much of the paint as possible from the tubs and tanks, water-based paint clean-up involves washing the equipment with water. The wash water may be disposed of in one of several ways, including (1) collected in tanks and treated before discharge, (2) collected in drums and disposed of in a landfill, (3) discharged directly to a sewer or receiving stream, (4) reused in the next paint batch, or (5) reused in the washing operation. Likewise with solvent-based paints, as much of the paint as possible is removed from the equipment by allowing it to drain out and through the use of squeegees. Then the equipment is flushed with a solvent. The used solvent is handled in one of three ways: (1) used in the next batch as part of the formulation, (2) collected in drums and sold to a company for redistillation and resale, or (3) collected in drums for subsequent tank-cleaning operations.

This chapter describes the size and financial characteristics of the industry, based of data available at this time from secondary sources. Much of this data is organized in terms of SIC codes. The category of interest in this analysis is SIC 2851: establishments primarily engaged in manufacturing paints (in paste and ready mixed form); varnishes; lacquers; enamels and shellac; putties, wood fillers and sealers; paint and varnish removers; paint brush cleaners and allied paint products.

8.3 Number and Location of Facilities

Over the last several years, there has been a reduction in the number of paint formulating facilities in the U.S. but there has been no major shifts in the location of these facilities. According to the U.S. Census of Manufactures, in 1982 there were 1,441 facilities classified as paint formulators (SIC 2851) by comparison, based on data collected by the Agency under authority of Section 308 of the Clean Water Act, there were 1,500 plants in 1976. Table 8-1 lists the number of plants located in each state having more than 150 employees in SIC 2851 in 1982. Data for other states is suppressed by the Census Bureau in order to maintain confidentiality. This table shows that in both 1976 and 1982, the five states with the largest number of plants were California, by far the largest; New Jersey; Illinois; New York; and Ohio. Together these five states accounted for 42 percent of all plants in 1976 and 44 percent of all plants in 1982. These five states are characterized by large populations and well-developed durable goods industries.

The formulating of paints is a highly specialized activity, tending to take place at facilities dedicated to that purpose. According to the 1982 Census of Manufactures, 97 percent of the plants that formulate paints have this as their major activity (i.e., 2851 is their primary SIC). In addition, 96 percent of paint is formulated at facilities with 2851 as their primary SIC.

8.4 Employment Characteristics

Based on data collected in 1976, the Agency categorized 65 percent of the plants in this industry as small, i.e., having less than 20 employees. As shown on Table 8-2, in 1982 about 57 percent of the plants had less than 20 employees. In addition, the total number of employees declined by nearly 18 percent between 1972 and 1982. Since 1982, employment in this industry has grown slightly. Table 8-3 lists the number of plants in various size categories for three different years. As shown, the distribution of plants across size categories has changed little in the last 10 years. While the data are from three different sources, they present a relatively consistent pattern of heavy concentration in the smallest size category with a slight shift towards larger facilities over time.

TABLE 8-1

LOCATION OF PAINT FORMULATING PLANTS

State	Number in 1982	Percent of Total	Number in 1976	Percent of Total
California	204	14%	196	13%
New Jersey	122	8	112	7
Illinois	118	8	106	7
New York	96	7	109	7
Ohio	90	6	103	7
Florida	83	6	69	5
Texas	80	6	58	4
Michigan	62	4	47	3
Pennsylvania	58	4	66	4
Missouri	54	4	51	3
Massachusetts	48	3	54	4
Wisconsin	37	3	34	2
Georgia	37	3	35	2
Indiana	35	2	34	2
North Carolina	26	2	20	1
Tennessee	25	2	17	1
Washington	24	2	22	1
Kentucky	20	1	22	1
Maryland	20	1	20	1
Connecticut	18	1	10	1
Minnesota	17	1	19	1
Oregon	17	1	20	1
Virginia	16	1	13	1

TABLE 8-1
(continued)

LOCATION OF PAINT FORMULATING PLANTS

State	Number in 1982	Percent of Total	Number in 1976	Percent of Total
Oklahoma	14	1	9	1
Alabama	14	1	12	1
Colorado	12	1	11	1
Iowa	12	1	13	1
Mississippi	10	1	5	0
Louisiana	9	1	15	1
Kansas	8	1	10	1
Arkansas	5	0	7	0
Utah	5	0	4	0
South Carolina	4	0	5	0
Not Identified	41	3	172	11
Total	1,441		1,500	

TABLE 8-2

SIZE OF THE PAINT FORMULATING INDUSTRY

	1972[1]	1977[1]	1982[1]	1984[2]	1985[2]	1986[2]
Companies	1,318	1,288	1,170			
Establishments						
Total	1,599	1,579	1,441			
20 or More Employees	687	653	620			
Employees (000)						
Total	65.9	61.4	54.1	55.3	56.7	56.9
Production	36.2	33.0	27.6	29.1	29.4	29.4
Value of Shipments ($ million)						
Current Dollars	3,822	6,630	9,162	10.848	10,539	11,101
1982 Dollars			9,162	10,412	9,924	10,250
New Capital Expenditures ($ million)						
Current Dollars	81.5	167.4	264.2	283.6	336.3	

SOURCE:

[1] U.S. Department of Commerce, Census of Manufactures, 1982
[2] U.S. Department of Commerce, 1987 Industrial Outlook, Section 15.

TABLE 8-3

DISTRIBUTION OF PLANTS BY NUMBER OF EMPLOYEES

Number of Employees	Percent of Plants		
	1976[1]	1982[2]	1987[3]
10 or Less	41.7%	36.6%	41.9%
11 to 20	21.2	20.3	17.7
21 to 50	19.5	23.0	20.5
51 to 100	9.7	11.9	10.1
More than 100	7.7	8.3	9.8

SOURCE:

[1] Economic Impact Analysis, December 1981, EPA-440/2-81-026, Table 5.
[2] U.S. Census of Manufactures, 1982, U.S. Department of Commerce.
[3] Dun's Census of American Business, Dun & Bradstreet, 1987.

8.5 Ownership Characteristics

The number of companies owning paint formulating plants steadily declined over the 1972 to 1982 period. Exact figures for more recent years are not available, but industry observers maintain that the consolidation trend has continued. As shown in Table 8-2, the number of companies has dropped from 1,318 in 1972 to 1,170 in 1982, or a drop of 11 percent. Nevertheless, the majority of companies continue to own only one paint formulating plant. The average number of plants per company in 1972 was 1.21 and the average in 1982 was 1.23. One reason for the generally fragmented nature of this industry is the relatively high transportation costs of the product. Therefore, it is more profitable to produce paint close to the point of sale. In addition, original equipment manufacturers (OEM) coatings are like specialty chemicals in that they are formulated for a specific customer and frequent contact with the customer is desirable.

A measure of the distribution of company sizes in this industry was derived from the 1987 Paint Red Book. This directory of paint procedures lists 847 companies, owning 1,342 plants that produce paint in the United States. Total company employment is listed for most of these companies. Out of the 847 companies, approximately 96 (11 percent) had more than 200 employees. Of these 96 companies, approximately one-third had between 200 and 299 employees, one-third had between 300 and 699 employees, and one-third had more than 700 employees including four companies with more than 5,000. Among the large companies that produce architectural coatings are: Sherwin Williams, Valspar Corp., and Benjamin Moore. Large OEM coating producers include: DuPont and Inmont (BASF). Large companies that produce both architectural and OEM coatings are: PPG Industries, Grow Group, DeSoto, and Glidden.

One reason for consolidation in this industry is the need for higher sales in order to support increased R&D expenditures. Some of the technological changes are in response to environmental regulations aimed at reducing emissions of organic compounds. Other changes are in response to needs of users, such as developing paints that make plastic automobile parts exactly match metal parts.

A second major trend is the increased globalization and integration of the industry. While several domestic companies have followed major OEMs out of the country to lower cost areas such as the Far East, foreign producers are entering the U.S. market in search of growth opportunities through acquiring existing paint companies. For example, BASF acquired Inmont Corp. in late 1985, and Imperial Chemicals Industries (ICI) acquired Glidden. This latter acquisition marked ICI's entry into the U.S. paint industry and made it the world's largest paint company. An example of increased vertical integration of the industry is DuPont's 1986 acquisition of Ford Motor Co.'s paint business. As a result, the automobile industry is primarily served by three companies: DuPont, PPG Industries, and Inmont.

The paint formulating industry is somewhat concentrated, with the four largest companies accounting for 24 percent of the shipments in 1982. However, despite a 20 percent decline in the number of companies owning paint formulating facilities between 1967 and 1982, there has been only a small increase in concentration as shown by the following data.

Year	Number of Companies	Percent of Shipments Accounted for by Largest Companies			
		Top 4	Top 8	Top 20	Top 50
1967	1,459	22 %	35%	48%	61%
1972	1,318	22	34	51	66
1977	1,288	24	36	52	67
1982	1,170	24	36	53	67

8.6 Products and Prices

Paints and coatings are formulated from over 1,000 raw materials, including:

- binders, to make paint adhere
- pigments, for color and protection
- solvents, to adjust viscosity
- additives, such as driers, plasticizers, and biocides

As described in an earlier section, paint is classified into three major market areas, and is produced in either water-based or solvent-based formulations. The usual unit of measure is the gallon and the average, wholesale price for paint was $9.47/gallon in 1985. This price is expected to rise to $11.96/gallon in 1990 and $14.77/gallon in 1995. As shown on Table 8-2, 1982 shipments were $9.162 billion. By 1986, shipments had increased to $11.101 billion (or $10.250 billion in 1982 dollars). This large increase is due to the depressed sales in 1982.

Architectural coatings are considered a mature market and long-term growth is projected at 2 percent per year. Sales reflect the level of new home construction, existing home sales, and to a lesser extent, commercial and industrial construction. Therefore they are very sensitive to business cycles.

The amount of OEM coatings shipped is projected to grow at only 1 to 2 percent per year over the long term, due to lower solvent usage. However, the dollar value of shipments is expected to increase much faster. These paints are also sensitive to business cycles.

Special-purpose coatings are not as sensitive to the business cycles. They are expected to grow at a rate similar to the rest of the industry.

8.7 Financial Characteristics

The paint formulating industry has relatively high operating and sales costs, due to the costs of purchasing raw materials and the necessity of marketing their products to a large number of wholesalers and manufactures. According to data provided by the industry National Paint and Coatings Association (NPCA), during the 1979 to 1986 period the total cost of manufactured goods ranged from 64.7 percent to 69.7 percent of sales and selling expenses ranged from 15.0 percent to 17.6 percent of sales.

During the same period, after-tax profits ranged from a low of 2.5 percent of sales in 1982 to a high of 3.2 percent of sales in 1984. However, profits measured against either net worth or working capital looked much better. After-tax profits as a percent of net worth ranged from a low of 8.9 percent in 1982 to a high of 13.8 percent in 1984. Table 8-4 presents several profit measures for each year from 1979 to 1986. As the table shows, the different profit measures move together, showing this industry's sensitivity to business cycles. All the profit data provided by the industry hit a low during the 1982 recession and climbed rapidly as the construction industry rebounded in 1984. The profit information provided by Robert Morris Associates (RMA) is based on individual establishments, not companies. In addition, each year's data reflects the particular paint formulating facilities applying for loans in that year. Nevertheless, the RMA data substantiates the profit levels shown in the industry data. The apparent one year lag in profit level response to the business cycle is in part due to the reporting conventions used by RMA.

Financial data on specific paint companies was not collected at this time for several reasons. Most of the companies are small and privately-held, and financial data are not available for them. Many of the large, publicly-held companies are diversified and data are not available on their paint business alone. Therefore, it was felt that the NPCA and RMA data provided a better picture of the overall industry than would be available from publicly available data on specific companies. Financial data for different sized facilities are presented in the next chapter.

8.8 Foreign Trade

Most of the sales by U.S. producers are directed at satisfying the domestic market. For example, in 1986 only $249 million (or 2.3 percent of paint industry shipments) were exported. In the same year, only $187 million of paint (or 1.7 percent of shipments plus imports) were imported. However imports have been increasing, both in absolute value and as a percent of shipments plus imports, while exports have remained constant or declined slightly. This decline is expected to continue, with net exports predicted to decline in terms of constant 1977 dollars from $154 million in 1977 to $68 million in 1995. In addition to direct imports and exports, U.S. manufactures are producing paint abroad and foreign companies are buying U.S. plants.

TABLE 8-4

HISTORIC PROFITABILITY LEVELS

Year	Before-tax Profits as Percent of Sales[1]	Before-tax Profits as Percent of Sales[2]	After-tax Profits as Percent of Sales[1]	After-tax Profits as Percent of Total Net Worth[1]	After-tax Profits as Percent of Net Working Capital[1]
1979	4.5	NA	2.8	11.3	14.5
1980	4.0	3.8	2.1	9.7	11.1
1981	3.8	4.0	2.4	12.0	13.0
1982	3.3	3.3	2.5	8.9	11.0
1983	4.6	2.5	3.1	11.9	14.0
1984	4.8	2.9	3.2	13.8	16.1
1985	4.4	4.2	3.1	11.5	12.6
1986	5.1	3.7	3.1	12.1	12.9

SOURCE:

[1] National Paint & Coatings Association.
[2] Annual Statement Studies, 1987, Robert Morris Assoc.

8.9 Trends in the Industry

As discussed above, this is a mature industry with a predicted annual growth rate of about 2 percent. However, certain new products such as powder coatings (sprayed on dry and then electrically adhered to the product being coated) and radiation curable coatings (liquid coatings hardened by ultraviolet light or electron beam energy) are predicted to grow at a rate of 12 to 15 percent per year. The number of both companies and plants has been declining and is expected to continue to decline as companies seek to increase sales and to provide more resources for their R&D efforts through consolidation. This need for aggressive R&D makes entering the market costly. Foreign firms have stepped up their activities in the U.S. market by buying significant shares of domestic companies and this is expected to continue as long as the dollar remains weak.

9.0 ECONOMIC IMPACT ASSESSMENT

Neither plant-specific financial data nor plant-specific compliance costs are available for this preliminary economic assessment. Therefore, financial profiles are developed for typical paint formulating plants and the range of potential impacts is analyzed.

9.1 Methodology

The analysis depends on several assumptions that were developed on the basis of the industry profile presented in the preceding chapter. The first assumption is that the plant is the appropriate unit of analysis. A majority of the plants are owned by single-plant companies, and so an analysis of the impact on company profits reduces to an analysis of plant profits. While this convergence is not true for plants owned by multi-plant companies, the data necessary to make separate analyses of profits for the plant and for its owner are not available at this time. However, the decision of whether or not to close a plant is usually based on the plant's circumstances. It is also assumed that the plant can be characterized on the basis of typical paint formulating plant financial performances. As described in the profile, most paint plants are exclusively paint producers and nearly all paint is produced at paint formulating plants.

Third, the analysis assumes that paint formulators are unable to pass-on any of the compliance costs in the form of higher prices. There are no data available at this time to allow an estimation of demand elasticities or cost pass-throughs. Assuming no cost pass-through is a worst case assumption in that it potentially over-estimates the impact on the industry. It is also a reasonable assumption in that there are many producers of paint and many of them already meet likely standards. Those who already meet the standards would not face increased costs, and this cost differential across producers would make it difficult for those with increased costs to raise their prices.

Based on operating cost and profit data provided by the industry and other secondary sources, financial profiles are developed for paint formulating plants typical of three different plant sizes. Since a majority of the plants in this industry are small, none of the size categories represents a large facility. These financial profiles allow a comparison of various compliance costs to changes in profit levels. Based on this comparison, different regulatory options can be evaluated in terms of their impact on profits. The likelihood of closure in response to various levels of compliance costs is not analyzed for these typical plants, since the data is not available at this time.

9.2 Definition of Typical Plants

The two primary sources of information for the financial profiles are the National Paint & Coatings Association (NPCA) and Robert Morris Associates (RMA). The NPCA surveys its members and publishes annual summaries of operating costs and profit levels. RMA annually publishes financial profiles, based on loan applications filed with its participating banks. The RMA statistics are aggregated by four-digit SIC code, and data for SIC 2851 are used in this analysis.

Data for 1986 are the most recent available from either source. As shown in Table 9-1, a comparison of 1986 data shows that the income statements are very similar. However, before-tax profits as reported by RMA are lower than those reported by NPCA. Less detailed information is available from Dun & Bradstreet, but like RMA, it shows lower profits than the NPCA data.

The RMA data are used for the typical financial profiles for two reasons. Its profit levels fall between the other two and so is neither the highest nor the lowest estimate. Secondly, it is likely that the NPCA data underrepresents small companies. Large companies are more likely to join an industry group and, as will be shown below, large facilities tend to have larger profits in relation to sales than small facilities. This is consistent with NPCA's higher reported profit levels.

RMA reports information for the total industry, representing 128 loan applications in 1986, and for each of three asset sizes, 0-$1 million, $1-$10 million, and $10-$50 million. The six plants with assets in excess of $50 million are not reported separately due to confidentiality restrictions. For each group, RMA reports total sales and number of facilities in the sample. From this, average sales are calculated. NPCA reported that sales per employee averaged $126,637 in 1986. Using this amount, the average number of employees is calculated for each size of plant. These figures are shown in Table 9-2. This table also presents the costs of goods as a percent of sales and before-tax profits as a percent of sales, net worth, and total assets.

The smallest asset category, with an average of 12 employees, corresponds to over 40 percent of the plants in this industry, while the plants in the two smaller asset categories represent over 80 percent of the plants in this industry. These two groups are roughly comparable in terms of their profits relative to sales and to total assets. However, in terms of profits relative to net worth, the smaller plants out perform the larger ones. The largest plants for which there is data are the most profitable by all measures.

TABLE 9-1

TYPICAL PAINT FORMULATING PLANT

	NPCA[1]	RMA[2]	D&B[3]
1986 Expenses and Profits as Percent of Sales			
Total Cost of Manufactured Products (including wage and benefits)	67.8%	68.5%	67.7%
Selling, Office, Administration and General Expenses	28.4%	28.5%	NA
Net Profit Before Taxes	5.1%	3.7%	NA
Net Profit After Taxes	3.1%	NA	2.1%
1986 Profits as Percent of Net Worth			
Net Profits Before Taxes as Percent of Net Worth	19.9%	17.0%	NA
Net Profits After Taxes as Percent of Net Worth	12.1%	NA	10.4%

SOURCE:

[1] Provided by the National Paint & Coatings Association.
[2] Annual Statement Studies, 1987, Robert Morris Assoc.
[3] Industry Norms and Key Business Ratios, 1986-87, Dun & Bradstreet.

TABLE 9-2

FINANCIAL PROFILES - TYPICAL PAINT PLANTS

	Asset Size in Million $ (Number of Establishments)			
	0-$1(33)	$1-$10(72)	$10-$50(17)	$50+(6)
Sales ($ million)	$1.58	$7.96	$48.44	$177.93
Employees	12	63	383	1,405
Cost of Goods Sold as Percent of Sales	68.5%	68.8%	68.3%	NA
Profit Before Taxes as Percent of Sales	3.0%	3.5%	5.3%	NA
Profit Before Taxes as Percent of Net Worth	16.7%	14.3%	24.6%	NA
Profit Before Taxes as Percent of Total Assets	5.7%	5.8%	8.8%	NA

SOURCE:

Annual Statement Studies, 1987, Robert Morris Associates Abt Associates Estimates.

9.3 Economic Impacts

Based on the sales and profitability ratios presented in Table 9-2 and the assumption that none of the compliance costs are passed-on in the form of higher prices, new profit levels are calculated for each of several compliance costs. These are shown in Table 9-3 and Figures 9-1, 9-2, and 9-3. Since the facility is assumed to absorb the entire costs, profits are reduced by the amount of the compliance costs, and profit rates drop accordingly. For the regulation with compliance costs equal to initial profits, profits are zero. The slope of this profit line is a function of the size of the initial profits and the profit rate before any additional regulations.

These graphs can be used to determine the amount of compliance costs a plant can absorb and still meet a given profitability criterion. For example, suppose the criterion is: profits should not be less than 3 percent of sales. In this case, small plants could not bear any additional regulations, while medium size plants could bear regulations with annual costs of up to $40,000, and large plants could bear regulations with costs of up to $1,100.000. This is diagrammed on Figures 9-1 to 9-3. These differences are due to both the size of the facility, and thus the absolute size of its profits, and its profit rate. Likewise, the cost of any regulatory option will vary with the size of the facility. A second example would be a criterion that profits not drop more than 25 percent. Under this rule, small plants could absorb annual compliance costs of up to $11,000, mid-size plants costs of up to $72,000, and large plants costs of up to $600,000. Note that due to the assumptions made, the cost which results in a 25 percent drop in the profit rate measured against sales is the same cost that results in a 25 percent drop in the profit rate measured against total assets.

Annual costs are based on the annualized portion of the capital costs plus the annual O&M costs of the treatment system. Therefore, a single annual cost can represent a wide range of capital and O&M combinations. To gain some perspective on the profit level changes displayed in Figures 9-1 to 9-3, compliance costs developed for an earlier analysis were inflated to estimate possible costs in 1986. The costs appear in the December 1981 EPA report Economic Impact Analysis for Controlling Water Pollution in the Paint Industry. The published costs were inflated from 1976 costs to 1988 costs by use of the GNP Implicite Price Deflator. This was used since the costs are a variable mix of construction and operating costs. The small plant in this analysis corresponds to the small plant in the earlier study, and the large plant here corresponds to the very large plant in that study. However, the medium size plant of this study falls mid-way between the medium and large plants of the earlier study. Therefore, an average of the compliance costs for those two plants was used for the medium size plant in this study. The resulting cost estimates, inflated to 1986, are presented in Table 9-4. A comparison of these costs to Figure 9-1 show that small plants would fail both of the hypothetical criteria under all of the treatment options. Initial

TABLE 9-3

IMPACT ON TYPICAL PLANT PROFITS[1]
VARIOUS ANNUAL COMPLIANCE COSTS

	Profits as Percent of Sales			Profits as Percent of Net Worth		
	Small	Medium	Large	Small	Medium	Large
No Additional Regulation	3.0%	3.5%	5.3%	5.7%	5.8%	8.8%
Regulation With Annual Cost of:						
$10,000	2.37	3.37	5.28	4.50	5.59	8.77
$25,000	1.42	3.19	5.25	2.69	5.28	8.71
$50,000	--	2.87	5.20	--	4.76	8.63
$100,000	--	2.24	5.09	--	3.72	8.46
$200,000	--	0.99	4.89	--	1.62	8.11
$500,000	--	--	4.27	--	--	7.09
$1,000,000	--	--	3.24	--	--	5.37
$1,500,000	--	--	2.20	--	--	3.66
$2,000,000	--	--	1.17	--	--	1.94

NOTES:

[1] Definitions of Plant Sizes:

Small Plant - 12 employees, $1.58 million in sales, 0.83 million in total assets.

Medium Plant - 63 employees, $7.96 million in sales, 4.8 million in total assets.

Large Plant - 383 employees, $48.44 million in sales, 29.17 million in total assets.

Figure 4. Impact on Profits of Small-Size Plants

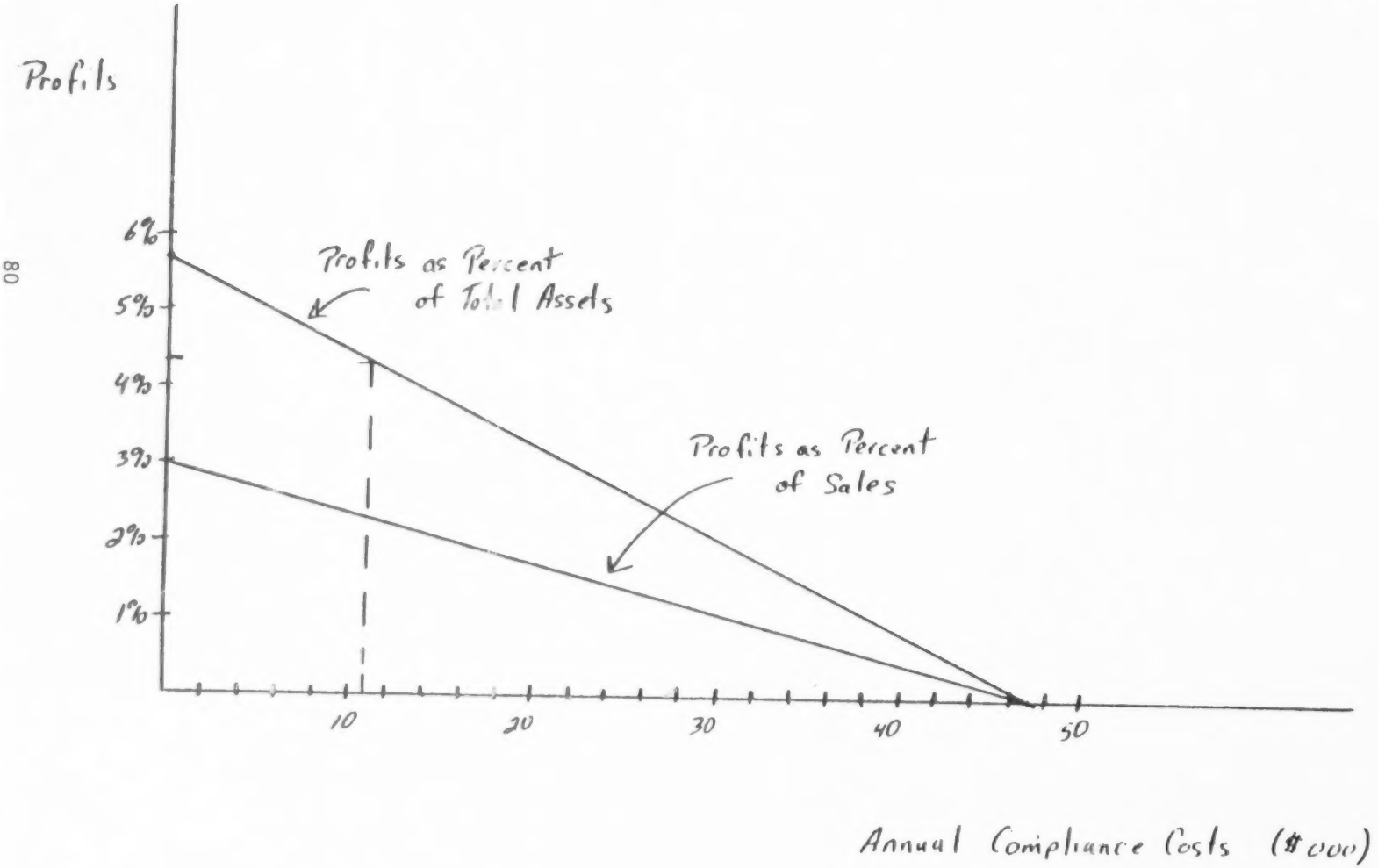


Figure 9. Impact on Profits of Medium-Size Plants

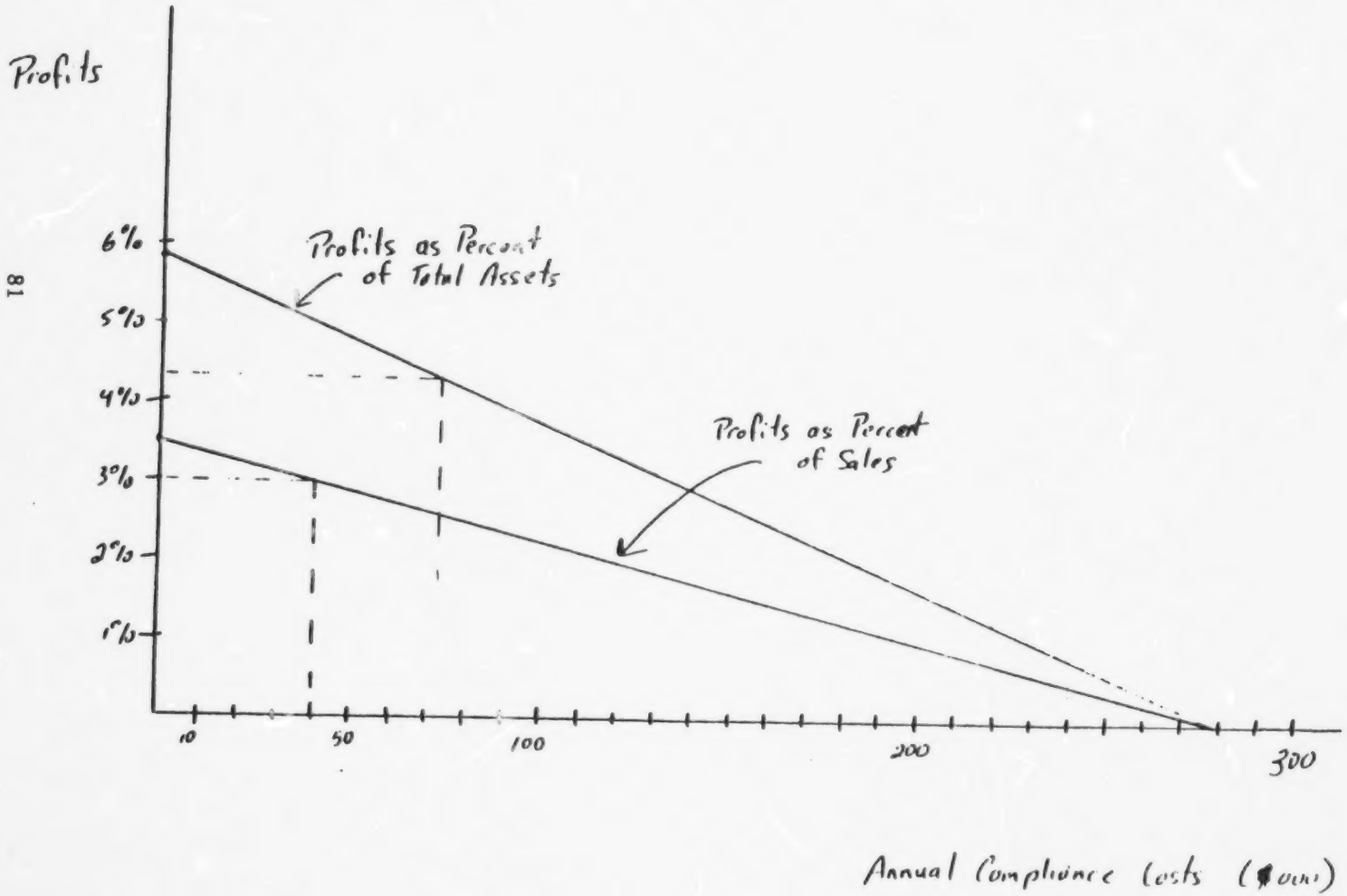
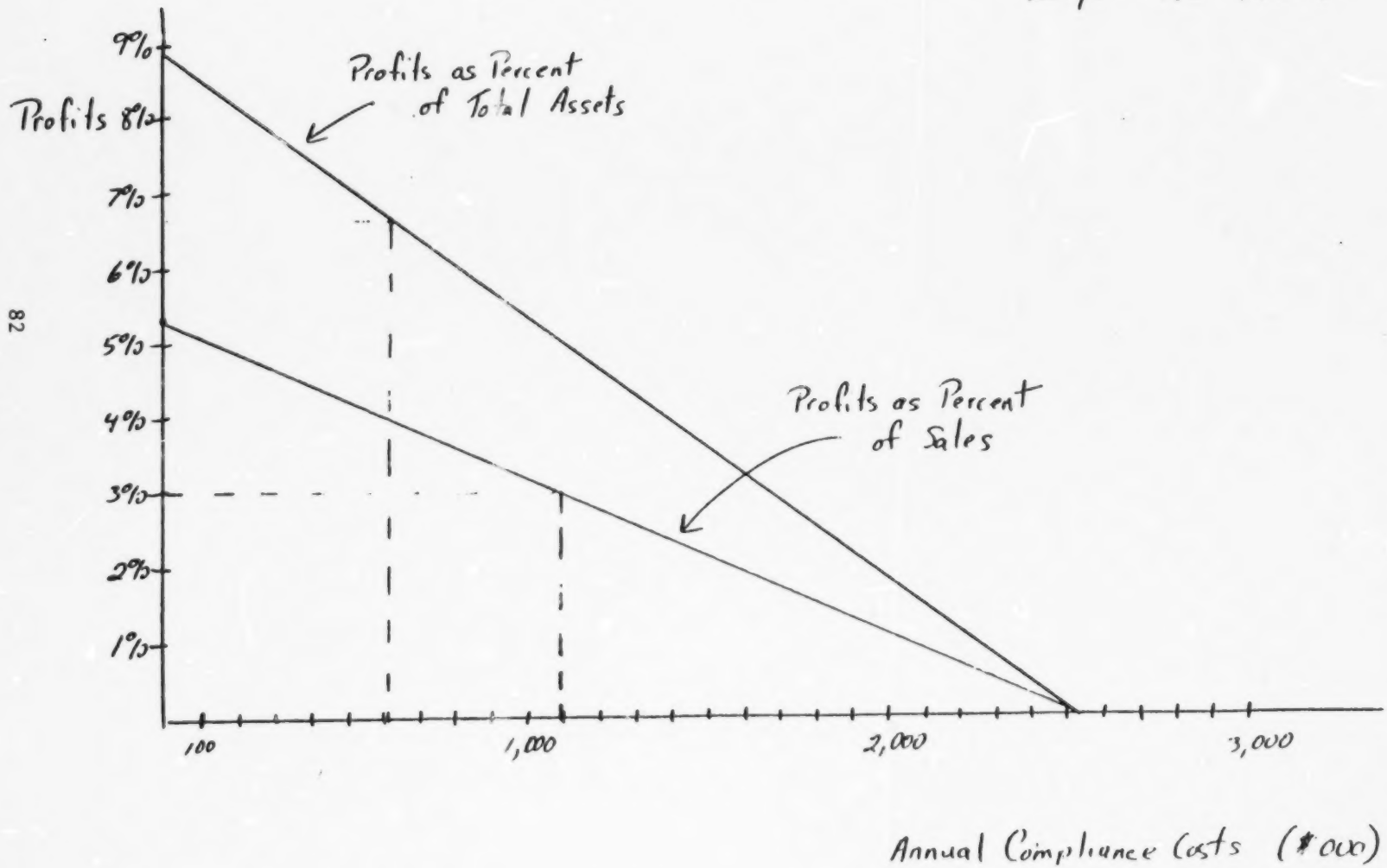


Figure 9-3. Impact on Profits of Large-Size Plants



profit rates start at 3 percent and the least expensive treatment option, contract hauling, would reduce profits by over 25 percent. In the case of mid-size plants, one of the treatment options, physical/chemical pretreatment, would pass the criterion of keeping profits above 3 percent. This option and three others (recycle with contract haul, recycle with physical/chemical, and contract hauling) would pass the criterion of not reducing profits by more than 25 percent. A comparison of the costs in Table 9-4 to Figure 9-3 shows that for large plants, all treatment options pass both criteria.

Based on this analysis of typical plant financial profiles and compliance costs developed for an earlier study, it is concluded that the medium and large size plants are capable of incurring additional treatment costs. However, the small plants that make up a majority of the plants in this industry could incur little in the way of additional costs without an undue burden. While this preliminary economic assessment does not take into account possible shifts in the competitive structure of the industry, nor identify possible closures, the basic conclusion that small plants will have difficulty meeting additional compliance costs while medium and large plants will not is well supported by the information currently available.

TABLE 9-4

ESTIMATED 1986 COMPLIANCE COSTS[1]
($ 000)

Treatment Option	Small Plant	Medium Plant	Large Plant
Physical/Chemical Pretreatment	$17.6	$39.6	$87.5
Physical/Chemical Pretreatment with Biological	$103.6	$125.8	$173.7
Recycle with Contract Haul	$23.4	$49.1	$92.9
Recycle with Physical/Chemical Pretreatment	$32.8	$53.2	$91.3
Recycle with Physical/Chemical Pretreatment and Biological	$118.9	$139.0	$176.2
Contract Haul	$12.7	$62.0	$226.1

NOTES:

[1] Calculated by inflating costs published in Economic Impact Analysis for Controlling Water Pollution in the Paint Manufacturing Industry, December 1981, EPA-440/2-81-026.

10.0 LIMITS OF THE ANALYSIS

The primary constraint on this preliminary economic impact analysis is the limited amount of data available. There is no information on some aspects of the industry and the data that is available is in aggregate form, thus hiding distinctions among plants.

10.1 Definition of Industry

The definition of the industry is not sufficiently detailed at this time to enable a complete comparison between this industry and SIC Group 2851. Most of the secondary source data is organized in terms of SIC 2851 and currently it is not possible to determine what errors the use of this data may introduce. For example, SIC 2851 includes paint and varnish removers and paint brush cleaners; does this industry? The error is of an unknown size, but probably small. Likewise. it is not known if the NPCA data includes facilities not covered by this regulation. The Paint Red Book does include makers of artist materials, such as Binney & Smith, which are not included in SIC 2851. A more detailed definition of the industry and a survey of facilities in this industry would provide the basis for eliminating these errors or at least estimating their size and type.

10.2 Economic/Financial Data

Plant-specific financial/economic data are not available at this time. Thus the analysis does not include differences among plants of the same size, such as differences in unit prices or operating costs. Using averages hides the range of impacts by not estimating the size and extent of the very largest nor the very smallest impacts. Second, the information needed to estimate the likelihood of closure or cost pass-throughs are not available from secondary sources. In both instances, this information could be collected via a survey of the industry, in combination with a clear definition of the industry (i.e., the universe under analysis). The survey should gather detailed information about products and markets, as well as balance sheet and income statement type information from individual plants. If the survey does not cover all facilities, then a sample must be drawn that is representative of the different markets within the paint industry, so that all sectors are covered and so that a clear picture of the competitive structure is developed. For example, which sectors or types of producers compete locally and which nationally?

10.3 Regulatory Options and Compliance Costs

Information gathered by the Agency indicates that many, if not most, paint formulating facilities already have some type of wastewater treatment in place. However, the extent and type of treatment varies, often dependent of the requirements imposed by the local POTW. This preliminary analysis could not take into account differences in compliance costs that are the result of differences in treatment in place. Plant-specific treatment

costs, that take into account amount of wastewater, pollutants, and treatment in place, would enable the economic impact analysis to be much more accurate. The range of impacts, changes in the competitive structure of the industry, and cost pass-throughs could be estimated if plant-specific costs were available.

ENVIRONMENTAL IMPACT ANALYSIS

11.0 ENVIRONMENTAL IMPACT ANALYSIS

A study is presented in this section of the impact of the wastewater discharge from the paint formulating industry on the publicly owned treatment works (POTW) and the stream to which the POTW subsequently discharges.

11.1 Summary of the Environmental Impact Study

This study evaluates the water quality impacts of four indirect paint plants on receiving streams and on publicly-owned treatment works (POTWs). Receiving stream impacts are evaluated by comparing instream pollutant concentrations with EPA Water Quality Criteria developed for human health and aquatic life protection and aquatic life toxic effects levels. Instream pollutant concentrations are calculated at two receiving stream flow conditions (25th and 50th percentile). The 25th percentile analyses mean that 75 percent of the receiving streams and 75 percent of the POTWs with indirect paint plants have flows greater than the evaluated flows. This type of analysis is representative of a worst case scenario.

Impacts on POTWs are evaluated In terms of inhibition of POTW operations and contamination of POTW sludges. Inhibition problems are estimated by comparing calculated POTW influent pollutant concentrations with POTW inhibition levels. Sludge contamination problems are estimated by comparing calculated sludge pollutant concentrations with phytotoxic sludge contamination levels. Two POTW flow conditions (25th and 50th percentile) were evaluated.

Actual discharge data from the four indirect paint plants (Plants A, B, D, and E) are used in the analyses (Table 11-1). These four plants discharge, individually, up to 34 pollutants (a total of 63 pollutants were evaluated); 27 are priority pollutants. Inhibition and sludge contamination criteria are not available for all the priority pollutants. Therefore, only 18 and 7 of the 27 priority pollutants are evaluated for potential inhibition problems and sludge contamination, respectively. Thirty-four of the pollutants evaluated have human health criteria or drinking water standards and 47 have aquatic life criteria/toxicity levels. Plants A and B only produce water-based paints, while Plants D and E both produce water and solvent-based paints.

The potential water quality impacts are projected to be minimal. Only two of the 64 evaluated pollutants (benzidine - Plant A and dichloromethane - Plant E) are projected to exceed human health criteria at both the 25th and 50th percentiles (Table 11-2). These two pollutants are known or suspected carcinogens. They are generally not persistent in water, having a half-life of 6 hours or less. Only one pollutant (mercury) is projected to exceed chronic aquatic life criteria (Plant D). One pollutant,

TABLE 11-1

PROFILE OF PAINT FORMULATING INDUSTRY
USED IN THE ENVIRONMENTAL IMPACT ANALYSIS

Number of Facilities

- Water based: Unknown
- Solvent-based: Unknown
  Total 1,440

Type of Discharge

- Direct: Unknown
- Indirect: Unknown

  Note: Solvent-based facilities generally do not discharge wastewater. The facilities evaluated in this report and in the Background Decision Document (ITD, 1987) are indirects.

- Frequency of Discharge: Primarily batch, due to the nature of tanking rinsing (the primary source of wastewater).

Plants Evaluated in this Analysis

- Plant A: Discharges 8,000 gpd. 100% water-based.
- Plant B: Discharges 1,600 gpd. 100% water-based.
- Plant D: Does not discharge wastewater; however, it generates 1,000 gpd of wastewater which is disposed of off-site. Thirty-five percent of this facility's production is water-based, the remaining is solvent-based. This facility was included as a comparison of solvent-based wastewaters.
- Plant E: Discharges 2,000 gpd. 95% water-based, 5% solvent-based.

Raw Pollutant Loadings to Water

- Information is not available from ITD (1987) to allow loadings from this subcategory to be calculated.

TABLE 11-2

SUMMARY OF WATER QUALITY CRITERIA EXCEEDANCES
RCRA/ITD SAMPLING DATA

Plant Number	Pollutant	Criteria Exceedances[1] 50th Percentile (POTW & Rec. Stream)	25th Percentile (POTW & Rec. Stream)
A	Zinc	--	I(2.7)
	Benzidine	H(185.6)	H(428.7)
B		No Exceedances	No Exceedances
D	Mercury	C(1.2)	C(2.9)
	Zinc	--	I(3.5)
E	Dichloromethane	H(2.7)	H(6.2)

NOTES:

[1] Criteria exceedances denoted by: type of criteria (concentration/criteria).

Types of criteria: H - Human health-ingesting water and organisms
C - Aquatic life-chronic
I - POTW inhibition

Total number of pollutant evaluated: 63

Number of priority pollutants evaluated: 27

Number of pollutants evaluated for potential inhibition problems: 18

Number of pollutants evaluated for potential sludge contamination problems: 7

Number of pollutants evaluated for potential human health/drinking water problems: 34

Number of pollutants evaluated for potential aquatic life problems: 47

zinc (Plants A and D) is projected to exceed inhibition levels at the 25th percentile. No pollutants exceed the sludge contamination levels.

11.2 Methodology

A POTW model was used to predict the potential environmental impacts associated with the raw indirect discharge of paint formulating wastewaters into POTWs and, ultimately, into receiving streams. The potential environmental impacts evaluated through the use of the POTW model include: (1) inhibition of POTW processes (determined by comparing calculated influent pollutant levels with available inhibition criteria or levels); (2) contamination of POTW sludge and thereby limiting its use (determined through comparison of expected pollutant concentrations in POTW sludge with sludge contamination criteria); and (3) effect on surface water into which the POTW discharges (determined through comparison of calculated POTW effluent concentrations with acute WQC for aquatic life, and calculated instream concentrations under low stream flow (7-Q-10) conditions with chronic aquatic life and human health WQC, and drinking water standards.

To determine potential environmental impacts of indirect dischargers, 50th (median) and 25th percentile POTW and receiving stream flows for the entire industry were used for each of the four plants evaluated. These POTW/receiving stream flows were based on information provided by the Agency's IFD and GAGE files for indirect facilities with a SIC code of 2851. Plant flows and concentrations were obtained from Section V of the "Background Decision Document for the Paint Formulating Point Source Category" (ITD, 1987). Average values were used when plants were sampled more than once.

11.3 Impacts on Human Health

Seven of the pollutants found in the wastewaters of these four plants are carcinogens (actual, suspected, or probable). Two of these pollutants, benzidine and dichloromethane (methylene chloride), caused exceedances of WQC for the protection of human health (ingesting water and organisms) under 25th and 50th percentile POTW and low (7-Q-10) receiving stream flows (Appendices D and E). Benzidine exceeded criteria by a factor of 429 using the 25th percentiles and methylene chloride concentration was 6.2 times higher than its criteria.

11.4 Impacts on Aquatic Life

Only one pollutant, mercury, exceeded aquatic life WQC after treatment by a POTW (Appendices D and E). At the 25th percentile flows, the exceedance factor was 2.9 (1.2 at the 50th percentiles).

11.5 POTW Impacts

Zinc was projected to cause inhibition of the treatment processes at two of the POTWs receiving wastewater from paint formulating

Zinc was projected to cause inhibition of the treatment processes at two of the POTWs receiving wastewater from paint formulating facilities (Appendices D and E). These exceedances of the inhibition criteria for zinc (30 μg/l) occurred only at the 25th percentile POTW flow (8.1 MGD).

11.6 Receiving Stream Profiles

Attachment 3 shows a ranking of the POTW and receiving stream flow (both average and low) for the indirect discharging paint formulating facilities contained in EPA's Industrial Discharge File (IDF).

11.7 Pollutant Fate

Pollutant fate information summaries for the most significant pollutants, in terms of loadings and/or criteria exceedances, are provided in Table 11-3.

TABLE 11-3

ENVIRONMENTAL FATE OF POLLUTANTS OF CONCERN

Pollutant	Fate
Benzidine	Sorption to sediments (especially clay) is the principal fate process. Oxidation by dissolved and precipitated metal cations, such as Fe^{+3}, Cu^{+2}, will degrade benzidine in surface waters (half-life = 6.0 hours). Not persistent.
Mercury	Mercury is strongly sorbed and persistent in the sediments and has a solubility of 0.03 mg/ℓ. Mercury will become biomethylated and volatilize to the atmosphere. It is transported cyclically between all environmental compartments. Mercury is bioaccumulated (BCF = 5,500).
Methylene chloride	Volatilization is the principal fate from surface water. The half-life ranges from less than one hour to several hours, depending on the agitation of the water. Biodegradation may occur in stagnant swamp water (cometabolism) but, generally, other forte processes are unimportant. This compound is not considered to be persistent. Bioaccumulative potential is low (BCF = 5.0).
Zinc	Zinc is strongly sorbed to both organic and inorganic components of the sediment where it will be persistent. Zinc is bioaccumulated by all organisms. BCF for freshwater fish is 432.

12.0 REFERENCES

Burns and Roe Industrial Services Corporation. Draft Development Document for Effluent Limitations Guidelines, Pretreatment Standards and New Source Performance Standards for the Paint and Ink Formulating Point Source Categories - Water-Base, Water-Wash, and Caustic-Wash Subcategories; Paramus, NJ; September 1976.

"Census of Manufacturers." Bureau of the Census; U.S. Department of Commerce; 1982.

Current Industry Practices in Waste Management, Ways to Generate Less. Devoe & Reynolds Co., Division of Grow Group; Survey of Paint Formulators; April 1986.

Environmental Protection Agency. Development Document for Effluent Limitations Guidelines and Standards for the Paint Formulating Point Source Category (Proposal); Washington, DC; December 1979.

Environmental Protection Agency. Report to Congress, Minimization of Hazardous Waste; Office of Solid Waste and Emergency Response; Washington, DC (unpublished); October 1986.

Environmental Protection Agency. Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works; Office of Water Regulations and Standards; Washington, DC; February 1986.

Kline Guide to the Paint Industry. 6th Edition; Charles H. Kline and Company; Fairfield, NJ; 1981.

Paint Red Book. 18th Edition; Communication Channels, Inc.; New York, NY; 1986.

SRI International. The U.S. Paint Industry: Technology Trends, Markets, Raw Materials; (Formerly NPCA Data Bank Program); September 1986.

APPENDIX A

DATA SUMMARIES FROM PREVIOUS STUDIES

TABLE A-1

DATA SUMMARY
1985 DSS SAMPLING PROGRAM
RAW WASTEWATER AND TREATED WASTEWATER
SAMPLES FROM A PAINT-FORMULATING FACILITY
(CODE E)

Pollutant Category and Pollutant	Raw Waste (μg/ℓ)	Treated Waste (μg/ℓ)
Type 1 Organics		
acetone	4,576	4,340
ethylbenzene	2,183	1,237
methylene chloride	481,612	366,752
phenol	1,818	1,472
styrene	2,329	1,608
toluene	621	352
2-butanone	119,736	106,502
Type 2 Organics		
1-chloro-2,3-epoxypropane	DET	--
methyl methacrylate	DET	--
n-propylamine	DET	DET
Pesticides/Herbicides		
4,4'-DDT	2.0	--
endosulfan sulfate	1130	--
endrin	110	1.2
Purgeable Organic Compounds	150	10
Dioxins/Furans		
	--	--

NOTE: See Table 5-2 Footnotes, for definitions of Type 1 and Type 2 Organics.

APPENDIX A
TABLE A-1

DATA SUMMARY
1985 DSS SAMPLING PROGRAM
RAW WASTEWATER AND TREATED WASTEWATER
SAMPLES FROM A PAINT-FORMULATING FACILITY
(CODE E)

Pollutant Category and Pollutant	Raw Waste (μg/ℓ)	Treated Waste (μg/ℓ)
Metals		
calcium	100,000	110,000
magnesium	26,000	23,000
sodium	790,000	2,800,000
aluminum	840	270
manganese	1,100	3,200
lead	122	--
boron	210	140
barium	1,260	253
cadmium	30	--
cobalt	334	96
chromium	4620	3,100
copper	58	58
iron	104,000	964
nickel	44	60
titanium	36	15
zinc	3,390	208
arsenic	58	--
antimony	--	16
osmium	170	--
strontium	13,300	7,180
Elements		
aluminum	DET	DET
calcium	DET	DET
carbon	DET	DET
cesium	DET	--
erbium	DET	DET
gadolinium	DET	--

TABLE A-1 (Continued)

DATA SUMMARY
1985 DSS SAMPLING PROGRAM
RAW WASTEWATER AND TREATED WASTEWATER
SAMPLES FROM A PAINT-FORMULATING FACILITY
(CODE E)

Pollutant Category and Pollutant	Raw Waste (mg/ℓ)	Treated Waste (mg/ℓ)
Conventional Pollutants		
BOD-5 Day (carbonaceous)	243	46
total suspended solids	2,970	16
Non-conventional Pollutants		
fluoride	0.5	0.9
ammonia, as N	61	47
nitrate-nitrite, as N	0.16	0.15
chemical oxygen demand	24,200	16,200
total organic carbon	4,950	4,800

-- Indicates that pollutant concentration was below detection limit.
NR No value reported due to matrix interference.
DET Indicates that pollutant concentration qualitatively detected.
Code E is plant 1034 From DSS Vol. II.

TABLE NO. A-2
AVERAGE UNTREATED WASTEWATER CONCENTRATIONS
1976 PAINT SAMPLING PROGRAM
SAMPLING OF NINE PAINT-FORMULATING FACILITIES

PARAMETER	PLANT CODE								
	76-A	76-B	76-C	76-D	76-E	76-F	76-G	76-H	76-J
Metals (mg/ℓ)									
aluminum	12	140	240	66	280	100	35.6	510	100
antimony	1.0	0.45	0.37	0.45	0.33	1.9	0.1	10	0.5
barium	1.7	20	0.66	0.61	0.32	2.7	0.1	0.25	2.2
boron	0.31	1.6	0.28	0.5	1.4	8.9	21	1.0	1.4
cadmium	0.01	0.06	0.09	0.04	0.015	0.07	0.01	0.15	0.86
chromium (total)	13	15	0.23	0.12	0.08	32	0.01	--	0.14
cobalt	0.38	1.5	0.10	0.35	0.67	1.1	0.17	8.5	3.5
copper	0.15	0.47	0.49	0.38	0.3	0.38	0.13	0.55	0.3
iron	2.9	81	12	82	100	31	1.6	600	4.5
lead	14	22	0.43	0.61	0.25	92	0.20	0.85	0.42
manganese	0.06	7.5	0.21	18	0.35	0.69	0.05	0.53	0.10
mercury (μg/ℓ)	0.9	2.0	1.1	14	0.5	0.4	0.7	0.004	1.2
molybdenum	0.1	0.15	0.1	0.1	0.1	2.2	0.1	0.33	0.1
nickel	0.25	4.5	0.64	0.19	0.18	0.65	0.05	1.1	0.25
tin	0.5	1.2	0.5	0.5	0.5	1.9	0.5	27	0.38
titanium	16	200	280	59	220	140	.13	940	540
zinc	8	260	210	5.9	0.76	9.3	8.5	1300	740
Conventional Pollutants									
pH	10.9	8.2	7.8	7.6	7.6	12.4	8.0	9.1	8.8
BOD (mg/ℓ)	1,300	16,00	4,800	4,600	--	3,200	8,500	8,500	3,500
O & G (mg/ℓ)	300	1,700	1,400	1,400	1,700	1,200	1,400	2,300	2,400
TSS (mg/ℓ)	1,600	9,600	14,100	9,900	17,400	2,900	3,700	39,500	15,600
Non-conventional Pollutants									
COD (mg/ℓ)	3,000	42,300	14,900	22,600	41,100	12,800	28,200	63,800	27,900
COD (dissolved) (mg/ℓ)	1,800	16,500	4,300	7,100	7,400	7,800	5,900	15,200	4,200
TS (mg/ℓ)	4,000	23,900	20,000	20,400	29,300	102,100	14,500	48,600	36,000
Settleable Solids (μg/ℓ)	180	40	110	90	78	45	70	10,900	14
Total Dissolved Solids - (TDS) 9 (mg/ℓ)	2,400	12,500	5,900	10,400	11,900	99,900	10,800	9,100	17,600
Total Volatile Solids - (TVS) (mg/ℓ)	2,100	8,400	8,300	10,300	14,900	23,300	12,200	22,100	20,600
VSS (mg/ℓ)	900	3,200	5,400	3,900	6,400	1,600	2,600	16,700	4,800
VDS (mg/ℓ)	1,100	5,200	2,800	6,400	8,500	21,600	9,600	5,500	8,300
phenols (mg/ℓ)	2.5	0.4	0.1	0.7	0.2	0.1	0.1	2.6	1.1

TABLE NO. A-3
AVERAGE TREATED WASTEWATER CONCENTRATIONS
1976 PAINT SAMPLING PROGRAM
SAMPLING OF NINE PAINT-FORMULATING FACILITIES

PARAMETER	PLANT CODE								
	76-A	76-B	76-C	76-D	76-E	76-F	76-G	76-H	76-J
Metals (mg/ℓ)									
aluminum	18	57	2.9	20	24.8	10	3.2	530	45
antimony	1.0	0.38	0.2	0.1	0.125	4.1	0.5	13	0.07
barium	0.9	0.6	0.1	0.3	0.2	0.4	0.1	0.3	0.07
boron	0.4	2.6	0.2	0.4	0.66	7.4	0.1	1.0	1.0
cadmium	0.01	0.07	0.01	0.01	0.01	0.15	0.01	0.2	0.2
chromium (total)	10	7.6	0.02	0.04	0.02	19	0.01	--	0.01
cobalt	0.4	1.0	0.05	0.1	0.06	0.7	0.04	8.2	1.0
copper	0.07	0.02	0.1	0.3	3.6	0.6	0.05	0.3	0.1
iron	2.4	15	0.8	38	0.13	11	0.1	270	5.2
lead	6.8	2.4	0.2	0.2	0.05	19	0.8	0.7	0.06
manganese	0.02	2.4	0.04	8.1	0.53	0.3	0.03	1.0	0.2
mercury (μg/ℓ)	0.5	0.9	0.6	7.4	0.55	0.7	0.5	0.004	0.7
molybdenum	0.1	0.2	0.1	0.1	0.1	3.3	0.1	0.33	0.1
nickel	0.4	3.9	0.06	0.06	0.04	0.6	0.01	0.8	0.01
tin	0.5	0.6	0.5	0.5	0.5	3.9	0.5	23	0.5
titanium	33	17	17	17	7.2	1.0	1	440	380
zinc	6.0	230	0.9	3.9	0.02	8.2	0.13	1,400	100
Conventional Pollutants									
pH	10.7	6.0	7.1	7.2	7.1	9.4	7.5	6.4	5.7
BOD (mg/ℓ)	980	11,600	1,700	2,700	3,800	6,300	3,800	3,200	1,100
Oil & Grease (mg/ℓ)	220	250	20	1,100	170	870	37	1,300	160
TSS (mg/ℓ)	550	850	130	4,200	1,400	2,100	7.0	4,500	1,400
Non-conventional Pollutants									
COD (mg/ℓ)	3,500	21,000	9,000	16,500	9,500	24,600	6,900	7,800	3,300
COD (dissolved) (mg/ℓ)	1,500	16,100	3,500	5,800	4,900	10,900	6,600	4,200	2,000
TS (mg/ℓ)	3,000	14,700	6,000	8,700	4,900	85,000	3,900	10,200	3,200
settleable solids (μg/ℓ)	140	13	1.7	40	22	67	0.1	4,100	11
TDS 9 (mg/ℓ)	2,400	13,800	5,900	4,500	3,500	83,000	3,900	5,700	2,300
TVS (mg/ℓ)	1,600	3,000	870	6,800	3,000	19,000	570	3,700	2,000
VSS (mg/ℓ)	240	620	50	3,100	1,100	450	70	1,700	580
VDS (mg/ℓ)	1,400	3,400	790	3,700	1,900	18,600	60	2,000	680
phenols (mg/ℓ)	3.5	0.3	0.1	0.4	0.1	0.4	0.1	2.6	0.1

TABLE NO. A-4
RAW WASTEWATER DATA SUMMARY
1977/1978 SAMPLING PROGRAM
PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS

PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES ABOVE DET. LIMIT	AVERAGE (μg/ℓ)	MEDIAN (μg/ℓ)	MINIMUM (μg/ℓ)	MAXIMUM (μg/ℓ)
ORGANIC TOXIC POLLUTANTS						
acrolein	31	0	10	L 10	L 10	L 10
benzene	31	18	1,933	370	20	9,900
carbon tetrachloride	31	7	3,770	14	L 10	30,000
chlorobenzene	31	3	1,405	56	L 10	5,500
hexachlorobenzene	31	1	92	92	92	92
1,2-dichloroethane	31	4	118	33	L 10	420
1,1,1-trichloroethane	31	15	141	76	10	930
1,1-dichloroethane	31	1	11	11	L 10	13
1,1,2-trichloroethane	31	2	568	10	L 10	2,800
1,1,2,2-tetrachloroethane	31	1	20	20	L 10	30
2-chloronaphthalene	31	0	10	L 10	L 10	L 10
2,4,6-trichlorophenol	31	1	2,455	L 2,455	L 10	4,900
chloroform	31	15	186	92	16	900
3,3'-dichlorobenzidine	31	0	10	L 10	L 10	L 10
1,1-dichloroethylene	31	3	138	23	L 10	620
1,2-trans-dichloroethylene	31	1	135	135	L 10	260
2,4-dichlorophenol	31	0	10	L 10	L 10	L 10
1,2-dichloropropane	31	3	265	41	L 10	968
1,3-dichloropropylene	31	1	100	100	100	100
ethylbenzene	31	25	7,482	1,300	80	112,800
fluoranthene	31	0	10	L 10	L 10	L 10
4-chlorophenyl phenyl ether	31	1	266	266	266	266
di(2-chloroisopropyl) ether	31	1	3,200	3,200	3,200	3,200
di(2-chloroethyoxy) methane	31	0	10	L 10	L 10	L 10
methylene chloride	31	17	31,878	620	L 10	210,000
dichlorobromomethane	31	1	27	27	27	27
naphthalene	31	8	2,950	54	L 10	18,000
nitrobenzene	31	2	100	110	L 10	180
2,4-dinitrophenol	31	3	173	160	110	250
4,6-dinitro-o-cresol	31	0	10	L 10	L 10	L 10
pentachlorophenol	31	5	6,017	750	L 10	27,000

TABLE NO. A-4 (Continued)
RAW WASTEWATER DATA SUMMARY
1977/1978 SAMPLING PROGRAM
PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS

PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES ABOVE DET. LIMIT	AVERAGE (μg/ℓ)	MEDIAN (μg/ℓ)	MINIMUM (μg/ℓ)	MAXIMUM (μg/ℓ)
phenol	31	8	746	96	L 10	3,800
total phenols (Standard Methods)	56	45	260	125	L 1	1,900
di(2-ethylhexyl) phthalate	31	9	418	140	L 10	2,810
butyl benzyl phthalate	31	3	474	44	L 10	1,800
di-n-butyl phthalate	31	13	5,745	160	L 10	69,000
diethyl phthalate	31	1	233	L 10	L 10	680
benzo (A) pyrene	31	0	10	L 10	L 10	L 10
anthracene	31	0	10	L 10	L 10	L 10
tetrachloroethylene	31	16	567	175	L 10	4,900
toluene	31	27	17,966	2,500	73	259,700
trichloroethylene	31	12	81	23	L 10	250
aldrin	31	0	10	L 10	L 10	L 10
dieldrin	31	0	10	L 10	L 10	L 10
4'4'-DDE	31	0	10	L 10	L 10	L 10
4'4'-DDD	31	0	10	L 10	L 10	L 10
beta-endosulfan	31	0	10	L 10	L 10	L 10
endrin aldehyde	31	0	10	L 10	L 10	L 10
alpha-BHC	31	0	10	L 10	L 10	L 10
beta-BHC	31	0	10	L 10	L 10	L 10
gamma-BHC	31	0	10	L 10	L 10	L 10
delta-BHC	31	0	10	L 10	L 10	L 10
METALS						
aluminum	55	55	196,758	100,000	8,000	3,000,000
antimony	57	11	209	L 25	L 10	2,000
arsenic	48	25	286	L 69	L 20	2,000
barium	54	53	8,656	L 2,000	50	100,000
beryllium	60	14	126	10	2	3,990
boron	52	39	4,268	1,000	131	40,000
cadmium	60	29	524	L 20	8	15,600
calcium(mg/ℓ)	54	51	2,277	L 281	20	38,000
chromium	60	50	3,120	L 260	50	40,000

TABLE NO. A-4 (Continued)
RAW WASTEWATER DATA SUMMARY
1977/1978 SAMPLING PROGRAM
PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS

PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES ABOVE DET. LIMIT	AVERAGE (μg/ℓ)	MEDIAN (μg/ℓ)	MINIMUM (μg/ℓ)	MAXIMUM (μg/ℓ)
cobalt	54	41	912	300	L 20	11,600
copper	60	58	2,476	400	50	40,000
iron	54	54	271,307	40,000	3,000	6,000,000
lead	60	45	6,300	805	22	80,000
magnesium(mg/ℓ)	54	54	107	36	4	2,100
manganese	54	54	2,901	886	40	40,000
mercury	55	44	5,161	L 500	L 1	62,000
molybdenum	53	42	674	200	L 5	11,200
nickel	60	18	1,350	L 50	L 5	40,000
selenium	58	4	165	L 25	9	L 2,000
silver	59	5	15	L 10	L 1	L 100
sodium	54	45	397	205	L 60	2,900
thallium	59	11	151	L 10	6	L 2,000
tin	54	53	1,111	400	L 50	20,000
titanium	54	54	16,677	7,000	80	210,000
vanadium	53	25	409	L 100	32	11,400
yttrium	52	4	206	L 200	L 16	L 2,000
zinc	60	57	74,746	10,000	600	900,000
CONVENTIONAL POLLUTANTS						
pH	56	56		8	5	13
BOD(mg/ℓ)	54	54	9,892	4,850	280	65,500
oil & grease(mg/ℓ)	52	52	1,099	938	42	3,400
Total Suspended Solids(mg/ℓ)	50	50	20,424	12,800	280	148,000
NON-CONVENTIONAL POLLUTANTS						
COD(mg/ℓ)	57	57	54,956	39,000	1,201	350,000
TOC(mg/ℓ)	51	51	10,601	8,500	1,500	46,000
Total Solids(mg/ℓ)	51	51	28,945	22,750	90	160,000

TABLE NO. A-4 (Continued)
RAW WASTEWATER DATA SUMMARY
1977/1978 SAMPLING PROGRAM
PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS

PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES ABOVE DET. LIMIT	AVERAGE (μg/ℓ)	MEDIAN (μg/ℓ)	MINIMUM (μg/ℓ)	MAXIMUM (μg/ℓ)
TDS (mg/ℓ)	46	46	10,619	4,300	500	145,000
TVS (mg/ℓ)	46	46	13,017	11,350	960	31,700
VDS (mg/ℓ)	27	27	5,400	3,600	270	21,800
TVS (mg/ℓ)	29	29	7,789	7,600	160	25,000

All units ug/ℓ unless otherwise noted.
Average, Median, and Minimum values based only on number of times detected for organic toxic pollutants.
L = Less Than

TABLE NO. A-5
TREATED WASTEWATER DATA SUMMARY
1977/1978 SAMPLING PROGRAM
PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS

PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES ABOVE DET. LIMIT	AVERAGE (μg/ℓ)	MEDIAN (μg/ℓ)	MINIMUM (μg/ℓ)	MAXIMUM (μg/ℓ)
ORGANIC TOXIC POLLUTANTS						
benzene	27	12	684	307	L 10	3,800
carbon tetrachloride	27	2	643	120	L 10	1,800
chlorobenzene	27	0	10	L 10	L 10	L 10
1,2-dichloroethane	27	3	71	53	L 10	170
1,1,1-trichloroethane	27	10	81	L 16	L 10	560
1,1-dichloroethane	27	1	95	L 95	L 10	180
1,1,2-trichloroethane	27	3	930	805	L 10	2,100
choloroethane	27	0	10	L 10	L 10	L 10
2,4,6-trichlorophenol	27	2	2,400	2,400	1,100	3,700
chloroform	27	14	370	30	L 10	4,700
1,1-dichloroethylene	27	2	19	L 11	L 10	44
1,2-trans-dichloroethylene	27	4	51	27	L 10	188
1,2-dichloropropane	27	2	212	212	24	400
1-3-dichloropropylene	27	1	44	44	44	44
1,2-diphenylhydrazine	27	0	10	L 10	L 10	L 10
ethylbenzene	27	16	8,117	520	L 10	73,600
di(2-chloroethyoxy) methane	27	1	16	16	16	16
methylene chloride	27	19	5,600	1,700	L 10	31,000
isophorone	27	2	113	113	26	200
naphthalene	27	4	336	L 13	L 10	1,830
nitrobenzene	27	1	35	35	35	35
pentachlorophenol	27	3	105	L 10	L 10	405
phenol	27	11	163	36	L 10	1,240
total phenols	53	42	193	90	1	1,900
di(2-ethylhexyl) phthalate	27	3	36	L 10	L 10	160
butyl benzyl phthalate	27	4	695	67	L 10	2,500
di-n-butyl phthalate	27	5	227	L 10	L 10	1,300
diethyl phthalate	27	2	464	L 14	L 10	1,820
dimethyl phthalate	27	1	79	L 10	L 10	219
acenaphthylene	27	0	10	L 10	L 10	L 10
anthracene	27	0	10	L 10	L 10	L 10
phenanthrene	27	0	10	L 10	L 10	L 10

TABLE NO. A-5 (Continued)
TREATED WASTEWATER DATA SUMMARY
1977/1978 SAMPLING PROGRAM
PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS

PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES ABOVE DET. LIMIT	AVERAGE (μg/ℓ)	MEDIAN (μg/ℓ)	MINIMUM (μg/ℓ)	MAXIMUM (μg/ℓ)
tetrachloroethylene	27	7	191	35	L 10	700
toluene	27	21	2,408	990	43	13,200
trichloroethylene	27	8	72	14	L 10	300
4,4-DDE	27	0	10	L 10	L 10	L 10
endrin aldehyde	27	0	10	L 10	L 10	L 10
beta-BHC	27	0	10	L 10	L 10	L 10
METALS						
aluminum	51	41	12,219	3,000	L 50	100,000
antimony	52	6	182	L 25	L 10	L 2,000
arsenic	47	5	161	L 25	4	L 2,000
barium	50	26	1,572	L 50	L 5	30,000
beryllium	55	2	8	L 10	L 1	L 50
boron	48	33	2,499	900	137	10,000
cadmium	55	15	30	L 20	L 2	L 200
calcium(mg/ℓ)	50	38	309	160	8	1,220
chromium	55	29	1,209	L 50	L 5	30,000
cobalt	50	25	483	L 50	L 5	6,000
copper	55	44	1,636	100	13	60,000
iron	50	32	99,461	L 2,000	L 170	2,000,000
lead	55	21	1,362	200	L 20	40,000
magnesium(mg/ℓ)	50	50	22	11	2	81
manganese	50	44	1,814	200	L 5	30,000
mercury	50	35	689	156	L 1	4,400
molybdenum	49	22	196	L 50	L 5	6,000
nickel	55	13	2,842	L 50	L 5	80,000
selenium	53	2	178	L 25	L 2	L 2,000
silver	54	3	9	L 10	L 1	L 50
sodium	50	42	697	230	L 60	15,000
thallium	54	3	160	L 10	L 10	L 2,000
tin	50	27	175	L 50	L 5	2,000
titanium	50	26	1,785	L 200	L 15	30,000

TABLE NO. A-5 (Continued)
TREATED WASTEWATER DATA SUMMARY
1977/1978 SAMPLING PROGRAM
PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS

PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES ABOVE DET. LIMIT	AVERAGE (μg/ℓ)	MEDIAN (μg/ℓ)	MINIMUM (μg/ℓ)	MAXIMUM (μg/ℓ)
vanadium	49	6	83	L 100	L 10	200
yttrium	47	1	152	L 200	L 16	L 200
zinc	55	39	7,360	1,000	L 60	100,000
CONVENTIONAL POLLUTANTS						
pH	51	51		7	3	11
BOD(mg/ℓ)	50	48	5,282	3,750	6	32,000
oil & grease(mg/ℓ)	47	46	228	25	1	1,700
total suspended solids(mg/ℓ)	49	49	1,946	240	6	22,000
NON-CONVENTIONAL POLLUTANTS						
COD(mg/ℓ)	52	52	19,655	10,050	1,350	260,000
cyanide	47	5	53	L 20	L 1	530
TOC(mg/ℓ)	48	48	3,867	2,500	460	25,000
TS(mg/ℓ)	48	48	6,249	5,190	30	23,000
TDS(mg/ℓ)	45	45	4,451	3,960	844	14,966
TVS(mg/ℓ)	42	42	3,146	1,465	240	12,000
VDS(mg/ℓ)	42	42	1,839	1,120	184	9,990
TVSS(mg/ℓ)	42	42	1,307	102	2	8,200

All units μg/ℓ unless noted.
Average, Median, and Minimum values based only on number of times detected for organic toxic pollutants.
L = Less Than

TABLE NO. A-6
SLUDGE DATA SUMMARY
1977/1978 SAMPLING PROGRAM
PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS

PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES ABOVE DET. LIMIT	AVERAGE (μg/ℓ)	MEDIAN (μg/ℓ)	MINIMUM (μg/ℓ)	MAXIMUM (μg/ℓ)
ORGANIC TOXIC POLLUTANTS						
benzene	9	4	414	30	L 10	1,900
carbon tetrachloride	9	0	10	L 10	L 10	L 10
chlorobenzene	9	2	176	176	12	340
1,2-dichloroethane	9	1	17	17	17	17
1,1,1-trichloroethane	9	4	866	14	L 10	3,200
1,1,2,2-tetrachloroethane	9	1	13	13	L 10	17
2,4,6-trichlorophenol	9	0	10	L 10	L 10	L 10
chloroform	9	2	920	920	840	1,000
2,4-dimethylphenol	9	0	10	L 10	L 10	L 10
ethylbenzene	9	8	14,277	237	26	99,000
methylene chloride	9	8	120,201	1,735	300	900,000
naphthalene	9	3	366	202	L 10	1,050
2,4-dinitrophenol	9	1	18	L 18	L 10	27
pentachlorophenol	9	4	346	125	35	1,100
phenol	9	3	325	150	L 10	1,120
total phenols	37	30	552	166	L 1	6,000
di(2-ethylhexyl) phthalate	9	6	455	215	L 10	1,940
butyl benzyl phthalate	9	4	10,410	1412	18	38,800
di-n-butyl phthalate	9	4	3,622	70	L 10	17,750
diethyl phthalate	9	3	370	100	50	960
dimethyl phthalate	9	0	10	10	L 10	L 10
anthracene	9	1	210	L 210	L 10	410
pyrene	9	0	10	L 10	L 10	L 10
tetrachloroethylene	9	4	2,142	170	L 10	8,200
toluene	9	8	44,740	905	130	350,000
trichloroethylene	9	2	39	L 10	L 10	130
aldrin	9	0	10	L 10	L 10	L 10
beta-endosulfan	9	0	10	L 10	L 10	L 10
delta-BHC	9	0	10	L 10	L 10	L 10

TABLE NO. A-6 (Continued)
SLUDGE DATA SUMMARY
1977/1978 SAMPLING PROGRAM
PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS

PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES ABOVE DET. LIMIT	AVERAGE (μg/ℓ)	MEDIAN (μg/ℓ)	MINIMUM (μg/ℓ)	MAXIMUM (μg/ℓ)
METALS						
aluminum	37	37	867,154	60,000	50,000	3,000,000
antimony	17	7	1,579	150	L 10	13,000
arsenic	12	5	879	495	L 25	L 2,000
barium	36	36	9,831	4,345	72	50,000
beryllium	39	25	192	20	2	3,760
boron	34	29	2,965	2,000	175	14,200
cadmium	39	29	840	200	L 8	14,700
calcium(mg/ℓ)	36	36	2,870	914	250	30,200
chromium	39	37	7,050	700	L 50	90,000
cobalt	36	32	2,131	600	L 50	15,600
copper	39	39	7,121	1,000	216	80,000
iron	36	36	886,452	200,000	22,600	8,000,000
lead	39	37	10,770	3,000	100	80,000
magnesium(mg/ℓ)	36	35	156	79	L 1	1,500
manganese	36	36	7,249	5,000	300	50,000
mercury	36	31	15,061	640	5	220,000
molybdenum	35	34	1,680	1,000	L 50	15,000
nickel	39	27	10,443	L 200	L 20	200,000
selenium	36	2	547	L 250	8	L 2,000
silver	38	8	22	L 10	L 2	L 100
sodium	36	32	583	260	100	3,500
thallium	9	1	967	L 400	L 10	L 2,000
tin	36	36	2,640	2,000	200	14,500
titanium	36	36	38,345	20,000	1,000	230,000
vanadium	35	30	891	400	60	11,500
yttrium	33	12	207	L 200	45	L 600
zinc	39	36	230,946	90,000	600	2,000,000

TABLE A-6 (Continued)
SLUDGE DATA SUMMARY
1977/1978 SAMPLING PROGRAM
PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS

PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES ABOVE DET. LIMIT	AVERAGE (μg/ℓ)	MEDIAN (μg/ℓ)	MINIMUM (μg/ℓ)	MAXIMUM (μg/ℓ)
CONVENTIONAL POLLUTANTS						
pH	35	35		7	2	10
BOD(mg/ℓ)	34	34	24,982	10,200	1	150,000
Oil & Grease(mg/ℓ)	35	35	7,578	2,500	230	129,000
Total Suspended Solids(mg/ℓ)	33	33	101,201	70,000	100	466,100
NON-CONVENTIONAL POLLUTANTS						
COD(mg/ℓ)	38	38	171,641	130,000	7	950,000
cyanide	34	3	1,151	L 20	L 1	36,500
TOC(mg/ℓ)	36	36	35,126	29,500	12,000	108,000
TS(mg/ℓ)	32	32	107,785	78,000	8	470,000
TDS(mg/ℓ)	30	27	13,122	9,800	L 1	100,200
TVS(mg/ℓ)	31	31	39,438	37,000	3,100	187,000
VDS(mg/ℓ)	16	14	7,440	5,250	L 1	40,400
TVSS(mg/ℓ)	20	20	23,002	14,133	880	89,000

All units μg/ℓ unless noted.
Average, median, and minimum values based only on number of times detected for organic toxic pollutants.
L = Less Than

TABLE NO. A-7
INTAKE (TAP) WATER DATA SUMMARY
1977/1978 SAMPLING PROGRAM
PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS

PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES ABOVE DET. LIMIT	AVERAGE (μg/ℓ)	MEDIAN (μg/ℓ)	MINIMUM (μg/ℓ)	MAXIMUM (μg/ℓ)
ORGANIC TOXIC POLLUTANTS						
benzene	29	9	90	16	L 10	572
carbon tetrachloride	29	2	13	14	L 10	15
chlorobenzene	29	0	10	L 10	L 10	L 10
1,1,1-trichloroethane	29	6	36	18	L 10	110
1,1,2-trichloroethane	29	1	14	L 14	L 10	18
1,1,2,2-tetrachloroethane	29	0	10	L 10	L 10	L 10
2,4,6-trichlorophenol	29	0	10	L 10	L 10	L 10
chloroform	29	14	118	43	L 10	570
3,3-dichlorobenzidine	29	0	10	L 10	L 10	L 10
1,1-dichloroethylene	29	2	10	L 10	L 10	13
2,4-dichlorophenol	29	0	10	L 10	L 10	L 10
2,4-dinitrotoluene	29	0	10	L 10	L 10	L 10
ethylbenzene	29	2	163	61	L 10	420
fluoranthene	29	0	10	L 10	L 10	L 10
methylene chloride	29	16	428	67	L 10	2,200
bromoform	29	1	12	L 12	L 10	14
dichlorobromomethane	29	10	25	15	L 10	86
chlorodibromomethane	29	5	19	L 10	L 10	113
nitrobenzene	29	0	10	L 10	L 10	L 10
pentachlorophenol	29	0	10	L 10	L 10	L 10
total phenols	21	6	17	L 20	L 1	40
di(2-ethylhexyl) phthalate	29	0	10	L 10	L 10	L 10
butyl benzyl phthalate	29	0	10	L 10	L 10	L 10
di-n-butyl phthalate	29	2	28	L 10	L 10	100
di-n-octyl phthalate	29	0	10	L 10	L 10	L 10
diethyl phthalate	29	0	10	L 10	L 10	L 10
3,4-benzofluoranthene	29	0	10	L 10	L 10	L 10
11,12-benzofluoranthene	29	0	10	L 10	L 10	L 10
anthracene	29	0	10	L 10	L 10	L 10
tetrachloroethylene	29	0	10	L 10	L 10	L 10
toluene	29	3	281	L 10	L 10	2,700
trichloroethylene	29	0	10	L 10	L 10	L 10

TABLE NO. A-7 (Continued)
INTAKE (TAP) WATER DATA SUMMARY
1977/1978 SAMPLING PROGRAM
PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS

PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES ABOVE DET. LIMIT	AVERAGE (μg/ℓ)	MEDIAN (μg/ℓ)	MINIMUM (μg/ℓ)	MAXIMUM (μg/ℓ)
endrin aldehyde	29	0	10	L 10	L 10	L 10
alpha-BHC	29	0	10	L 10	L 10	L 10
beta-BHC	29	0	10	L 10	L 10	L 10
gamma-BHC	29	0	10	L 10	L 10	L 10
METALS						
aluminum	24	12	1,303	L 500	L 50	20,000
antimony	25	3	10	L 10	L 2	L 25
arsenic	25	3	18	L 25	L 2	L 25
barium	23	17	64	L 50	5	600
beryllium	27	2	6	L 4	L 1	L 20
boron	21	9	382	500	L 50	1,000
cadmium	27	8	25	L 20	L 2	L 200
calcium(mg/ℓ)	23	13	53	40	L 10	210
chromium	27	12	36	L 20	L 5	200
cobalt	23	1	25	L 20	L 5	L 50
copper	27	17	174	60	6	959
iron	23	8	1,029	L 700	L 17	3,000
lead	26	7	105	L 80	L 10	400
magnesium(mg/ℓ)	23	20	20	10	L 1	81
manganese	22	9	33	45	5	70
mercury	24	3	1	L 1	L 1	L 5
molybdenum	22	6	28	L 20	L 5	60
nickel	26	4	32	L 20	L 5	200
selenium	25	2	18	L 25	L 2	L 25
silver	27	2	8	L 10	L 1	L 20
sodium	23	6	90	L 60	L 15	240
thallium	25	0	10	L 10	L 2	L 20
tin	21	16	80	L 50	L 5	300
titanium	22	3	101	L 60	L 15	200
vanadium	22	1	55	L 50	L 10	L 100
yttrium	19	0	114	L 60	L 16	L 200
zinc	26	19	974	L 600	40	8,000

TABLE NO. A-7 (Continued)
INTAKE (TAP) WATER DATA SUMMARY
1977/1978 SAMPLING PROGRAM
PRIORITY POLLUTANTS, CONVENTIONALS, AND NON-CONVENTIONALS

PARAMETER	NUMBER OF SAMPLES ANALYZED	NUMBER OF TIMES ABOVE DET. LIMIT	AVERAGE (μg/ℓ)	MEDIAN (μg/ℓ)	MINIMUM (μg/ℓ)	MAXIMUM (μg/ℓ)
CONVENTIONAL POLLUTANTS						
pH	22	22		7	6	9
BOD(mg/ℓ)	22	2	3	L 2	L 1	L 6
Oil & Grease(mg/ℓ)	18	4	1	L 1	L 1	L 5
Total Suspended Solids(mg/ℓ)	20	17	3	3	1	11
NON-CONVENTIONAL POLLUTANTS						
COD(mg/ℓ)	26	15	9	L 5	2	40
Cyanide	20	20	22	L 20	L 1	93
TOC(mg/ℓ)	23	18	7	5	L 1	20
TS(mg/ℓ)	20	19	318	187	10	1,500
TDS(mg/ℓ)	18	18	338	187	29	1,491
TVS(mg/ℓ)	17	17	62	33	12	190
VDS(mg/ℓ)	17	17	56	28	4	188
TVSS(mg/ℓ)	18	12	1	1	L 1	8

All units μg/ℓ unless noted.
Average, Median, and Minimum values based only on number of times detected for organic toxic pollutants.
L = Less Than

APPENDIX B

LIST OF PRIORITY POLLUTANTS ANALYZED FOR IN WASTEWATER OF PAINT PLANTS A, B, C, AND D

APPENDIX B

LIST OF PRIORITY POLLUTANTS ANALYZED IN THE WASTEWATER OF PAINT PLANTS A,B,C, and D.

I. METALS

ANTIMONY
ARSENIC
BERYLLIUM
CADMIUM
CHROMIUM
COPPER
LEAD
MERCURY
NICKEL
SELENIUM
SILVER
THALLIUM
ZINC

II. MISCELLANEOUS

ASBESTOS *
CYANIDES

III. DIBENZO-P-DIOXINS AND DIBENZOFURANS

2,3,7,8-TCDD

IV. PURGEABLE

1,1,1-TRICHLOROETHANE
1,1,2,2-TETRACHLOROETHANE
1,1,2-TRICHLOROETHANE
1,1-DICHLOROETHANE
1,1-DICHLOROETHENE
1,2-DICHLOROETHANE
1,2-DICHLOROPROPANE
1,3-DICHLOROPROPYLENE
2-CHLOROETHYL VINYL ETHER
ACROLEIN
ACRYLONITRILE
BENZENE
BROMOFORM
BROMODICHLOROMETHANE
BROMOMETHANE
CARBON TETRACHLORIDE
CHLOROBENZENE
CHLOROETHANE
CHLOROFORM
CHLOROMETHANE
DIBROMOCHLOROMETHANE
ETHYL BENZENE
METHYLENE CHLORIDE
TETRACHLOROETHENE
TOLUENE
TRANS-1,2-DICHLOROETHENE
TRICHLOROETHENE
VINYL CHLORIDE

V. EXTRACTABLE

A. PESTICIDES

1. ORGANOHALIDE

4,4'-DDD
4,4'-DDE
4,4'-DDT
ALDRIN
ALPHA-BHC
BETA-BHC
CHLORDANE
DELTA-BHC
DIELDRIN
ENDOSULFAN I
ENDOSULFAN II
ENDOSULFAN SULFATE
ENDRIN
ENDRIN ALDEHYDE
GAMMA-BHC
HEPTACHLOR
HEPTACHLOR EPOXIDE
PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260
TOXAPHENE

B. SEMI-VOLATILES

1. ACIDS

2,4,6-TRICHLOROPHENOL
2,4-DICHLOROPHENOL
2,4-DIMETHYLPHENOL
2,4-DINITROPHENOL
2-CHLOROPHENOL
2-NITROPHENOL
4-NITROPHENOL
DINITROCRESOL
PENTACHLOROPHENOL
PHENOL

2. BASES

1,2-DIPHENYLHYDRAZINE
2,4-DINITROTOLUENE
2,6-DINITROTOLUENE
3,3-DICHLOROBENZIDINE
4-BROMOPHENYL PHENYL ETHER
4-CHLORO-3-METHYLPHENOL
4-CHLOROPHENYL PHENYL ETHER
BENZIDINE
bis(2-CHLOROETHYL)ETHER
bis(2-CHLOROISOPROPYL)ETHER

B. SEMI-VOLATILES

2. BASES

DI-N-PROPYLNITROSAMINE
FLUORENE
ISOPHORONE
N-NITROSODIMETHYLAMINE
N-NITROSODIPHENYLAMINE
NITROBENZENE
PYRENE

3. NEUTRALS

a. PHTHALATES

BIS(2-ETHYLHEXYL)PHTHALATE
BUTYL BENZYL PHTHALATE
DI-N-BUTYL PHTHALATE
DI-N-OCTYL PHTHALATE
DIETHYL PHTHALATE
DIMETHYL PHTHALATE

b. POLYNUCLEAR AROMATIC

2-CHLORONAPHTHALENE
ACENAPHTHENE
ACENAPHTHYLENE
ANTHRACENE
BENZO(A)ANTHRACENE
BENZO(A)PYRENE
BENZO(B)FLUORANTHENE
BENZO(GHI)PERYLENE
BENZO(K)FLUORANTHENE
CHRYSENE
DIBENZO(A,H)ANTHRACENE
FLUORANTHENE
INDENO(1,2,3-CD)PYRENE
NAPHTHALENE
PHENANTHRENE

c. CHLORINATED HYDROCARBONS

1,2,4-TRICHLOROBENZENE
1,2-DICHLOROBENZENE
1,3-DICHLOROBENZENE
1,4-DICHLOROBENZENE
bis(2-CHLOROETHOXY)METHANE
HEXACHLOROBENZENE
HEXACHLOROBUTADIENE
HEXACHLOROCYCLOPENTADIENE
HEXACHLOROETHANE

* NOT ANALYZED FOR SAMPLES COLLECTED.

APPENDIX C

LIST OF NON-PRIORITY POLLUTANTS ANALYZED FOR IN WASTEWATER OF PAINT PLANTS A, B, C, AND D

APPENDIX C

LIST OF NON-PRIORITY POLLUTANT PARAMETERS ANALYZED IN WASTEWATER OF PAINT PLANTS A,B,C, and D

I. ELEMENTS

ALUMINUM
BARIUM
BISMUTH
BORON
CALCIUM
CERIUM
COBALT
DYSPROSIUM
ERBIUM
EUROPIUM
GADOLINIUM
GALLIUM
GERMANIUM
GOLD
HAFNIUM
HOLMIUM
INDIUM
IODINE
IRIDIUM
IRON
LANTHANUM
LITHIUM
LUTETIUM
MAGNESIUM
MANGANESE
MOLYBDENUM
NEODYMIUM
NIOBIUM
OSMIUM
PALLADIUM
PHOSPHORUS
PLATINUM
POTASSIUM
PRASEODYMIUM
RHENIUM
RHODIUM
RUTHENIUM
SAMARIUM
SCANDIUM
SILICON
SODIUM
STRONTIUM
SULFUR
TANTALUM
TELLURIUM
TERBIUM
THORIUM
THULIUM
TIN
TITANIUM
TUNGSTEN
URANIUM
VANADIUM
YTTERBIUM
YTTRIUM
ZIRCONIUM

III. DIBENZO-P-DIOXINS AND DIBENZOFURANS

DIBENZOFURAN
HEPTACHLORODIBENZO-P-DIOXINS
HEPTACHLORODIBENZOFURANS
HEXACHLORODIBENZO-P-DIOXINS
HEXACHLORODIBENZOFURANS
OCTACHLORODIBENZO-P-DIOXINS
OCTACHLORODIBENZOFURANS
PENTACHLORODIBENZO-P-DIOXINS
PENTACHLORODIBENZOFURANS
TETRACHLORODIBENZO-P-DIOXINS
TETRACHLORODIBENZOFURANS

IV. PURGEABLE

1,1,1,2-TETRACHLOROETHANE
1,2,3-TRICHLOROPROPANE
1,2-DIBROMOETHANE
1,3-DICHLOROPROPANE
1,3-DICHLORO-2-PROPANOL
1,4-DIOXANE
1-BROMO-2-CHLOROBENZENE
1-BROMO-3-CHLOROBENZENE
2-BUTENAL
2-HEXANONE
2-PICOLINE
3-CHLOROPROPENE
4-METHYL-2-PENTANONE
ACETONE
ALLYL ALCOHOL
CARBON DISULFIDE
CHLOROPRENE
CIS-1,3-DICHLOROPROPENE
DIBROMOCHLOROPROPANE
DIBROMOMETHANE
DICHLOROFLUOROMETHANE
DIETHYL ETHER
DIMETHYL SULFONE
ETHYL CYANIDE
ETHYL METHACRYLATE
ISOBUTYL ALCOHOL
METHACRYLONITRILE
METHYL ETHYL KETONE
METHYL IODIDE
METHYL METHACRYLATE
N,N-DIMETHYLFORMAMIDE
TRANS-1,3-DICHLOROPROPENE
TRANS-1,4-DICHLORO-2-BUTENE
TRICHLOROFLUOROMETHANE
VINYL ACETATE

V. EXTRACTABLE

A. PESTICIDES

1. ORGANOHALIDE

CAPTAFOL
CAPTAN
CHLOROBENZILATE
ENDRIN KETONE
ISODRIN
KEPONE
METHOXYCHLOR
MIREX
NITROFEN
PCNB

2. CARBAMATES

ETHYLENEBISDITHIOCARBAMIC ACID,SALTS, AND ESTERS
MANEB
NABAM
THIRAM
ZINEB
ZIRAM

3. ORGANOPHOSPHORUS

AZINPHOS-ETHYL
AZINPHOS-METHYL
CARBOPHENOTHION
CHLORFENVINPHOS
CHLORPYRIFOS
COUMAPHOS

3. ORGANOPHOSPHORUS

CROTOXYPHOS
CYGON
DEMETON
DIAZINON
DICHLORVOS
DICROTOPHOS
DIOXATHION
DISULFOTON
EPN
ETHION
FAMPHUR
FENSULFOTHION
FENTHION
HEXAMETHYLPHOSPHORAMIDE
LEPTOPHOS
MALATHION
METHYL PARATHION
MEVINPHOS
MONOCROTOPHOS
NALED
PARATHION ETHYL
PHORATE
PHOSMET
PHOSPHAMIDON
SULFOTEPP
TEPP
TERBUFOS
TETRACHLORVINPHOS
TRICHLOROFON
TRICRESYLPHOSPHATE
TRIMETHYLPHOSPHATE

4. HERBICIDES

2,4-D
2,4,5-T
2,4,5-TP
DIALLATE
DICHLONE
DINOSEB
TRIFLURALIN

B. SEMI-VOLATILES

1. ACIDS

2,3,4,6-TETRACHLOROPHENOL
2,3,6-TRICHLOROPHENOL
2,4,5-TRICHLOROPHENOL
2,6-DICHLOROPHENOL
BENZOIC ACID
CARBAZOLE
HEXANOIC ACID
MALACHITE GREEN
O-CRESOL
P-CRESOL
P-CYMENE
PHENACETIN
THIOPHENOL

2. BASES

1,3-DICHLORO-2-PROPANOL
1,3,5-TRITHIANE
1,4-DINITROBENZENE
1,4-NAPHTHOQUINONE
1,5-NAPHTHALENEDIAMINE
1-CHLORO-3-NITROBENZENE
1-METHYLFLUORENE
1-METHYLPHENANTHRENE
1-NAPHTHYLAMINE

APPENDIX C

LIST OF NON-PRIORITY POLLUTANT PARAMETERS ANALYZED IN WASTEWATER OF PAINT PLANTS A;B.C. and D

2. BASES

1-PHENYLNAPHTHALENE
2,3-DICHLOROANILINE
2,3-DICHLORONITROBENZENE
2,3-BENZOFLUORENE
2,4,5-TRIMETHYLANILINE
2,4-DIAMINOTOLUENE
2,6-DI-TERT-BUTYL-P-BENZOQUINONE
2-ISOPROPYLNAPHTHALENE
2-(METHYLTHIO)BENZOTHIAZOLE
2-METHYLBENZOTHIOAZOLE
2-METHYLNAPHTHALENE
2-NAPHTHYLAMINE
2-NITROANILINE
2-PHENYLNAPHTHALENE
3,3-DIMETHOXYBENZIDINE
3,6-DIMETHYLPHENANTHRENE
3-METHYLCHOLANTHRENE
3-NITROANILINE
4,4'-METHYLENEbis(2-CHLOROANILIN
4,5-METHYLENE PHENANTHRENE
4-AMINOBIPHENYL
4-CHLORO-2-NITROANILINE
4-NITROBIPHENYL
5-CHLORO-O-TOLUIDINE
5-NITRO-O-TOLUIDINE
7,12-DIMETHYLBENZ(a)ANTHRACENE
ACETOPHENONE
ANILINE
ARAMITE
BENZANTHRONE
BENZYL ALCOHOL
bis(CHLOROMETHYL)ETHER

B. SEMI-VOLATILES

2. BASES

BROMOXYNIL
CHLOROACETONITRILE
DICHLORAN
DIBENZOTHIOPHENE
DIPHENYL ETHER
DIPHENYLAMINE
ERYTHRITOL ANHYDRIDE
MESTRANOL
METHAPYRILENE
METHYL METHANESULFONATE
N,N-DIMETHYLFORMAMIDE
N-NITROSODI-N-BUTYLAMINE
N-NITROSODIETHYLAMINE
N-NITROSOMETHYLPHENYLAMINE
N-NITROSOMETHYLETHYLAMINE
N-NITROSOMORPHOLINE
N-NITROSOPIPERIDINE
O-ANISIDINE
O-TOLUIDINE
P-CHLOROANILINE
P-DIMETHYLAMINOAZOBENZENE
P-NITROANILINE
PHENOTHIAZINE
PRONAMIDE
PYRIDINE
THIANAPHTHENE
TRIPHENYLENE
TRIPROPYLENEGLYCOL METHYL ETHER

3. N-ALKANES

N-DECANE
N-DOCOSANE
N-DODECANE
N-EICOSANE
N-HEXACOSANE
N-HEXADECANE
N-OCTACOSANE
N-OCTADECANE
N-TETRACOSANE
N-TETRADECANE
N-TRIACONTANE

4. OTHERS

1,2,3-TRICHLOROBENZENE
1,2,3-TRIMETHOXYBENZENE
1,2,4,5-TETRACHLOROBENZENE
ALPHA-TERPINEOL
BIPHENYL
DIPHENYL SULFIDE
ETHYLENETHIOUREA
ETHYLMETHANE SULFONATE
HEXACHLOROPROPENE
ISOSAFROLE
LONGIFOLENE
PENTACHLOROBENZENE
PENTACHLOROETHANE
PENTAMETHYLBENZENE
PERYLENE
RESORCINOL
SAFROLE
SQUALENE
STYRENE
THIOACETAMIDE
THIOXANTHONE

APPENDIX C

TABLE C-1 (Continued)

Non-Priority Test Parameters

Residue, Filterable
Residue, Non-Filterable
Ammonia, as N
Nitrogen, Kjeldahl, Total
Total Phosphorus
BOD-5
COD
Oil & Grease, Total Recoverable
Total Organic Carbon
Flash Point
pH, Soil
Corrosivity
Fluoride
Nitrate/Nitrite
Sulfide

APPENDIX D

POTW MODEL RESULTS USING 50TH PERCENTILE POTW AND RECEIVING STREAM FLOWS

[illegible]

[illegible] LEVEL: [illegible]
LOW STRENGTH FLOW

PLANT FLOW (MGD): 0.000
STRENGTH FLOW (MGD): 59.0

POND FLOW (MGD): 35.0
PLANT NO.: 8

POLLUTANT NAME	CONCENTRATION (UG/L)					CRITERIA (UG/L)						CONCENTRATION/CRITERIA						POLLUTANT LOADING (LB/DY)
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10 DDT	-	-	-	-	-	-	-	1.1 C	0.001 C	0.000024 C	-	-	-	-	-	-	-	-
14 Endosulfan sulfate	-	-	-	-	-	-	-	0.77 C	0.056 C	74 T	-	-	-	-	-	-	-	-
15 Endrin	-	-	-	-	-	-	-	0.19 C	0.0023 C	1 T	0.2 H	-	-	-	-	-	-	-
19 Isophorone	-	-	-	-	-	-	-	117,000 L	5,950 O	5,290 T	-	-	-	-	-	-	-	-
22 Antimony	191	0.0436	0.0140	0.0055	0.17	-	-	9,000 L	1,600 L	146 T	-	NR	NR	0.0	0.0	0.0	NR	3.2
23 Arsenic	-	-	-	-	-	100	-	360 C	190 C	0.0077 C	50 H	-	-	-	-	-	-	-
25 Beryllium	1.0	0.0003	NR	-	0.00	-	-	130 L	5.3 L	0.0068 C	-	NR	-	-	-	-	-	0.0
26 Cadmium	11	0.0025	0.0010	0.0004	0.01	20	20	3.9 C	1.1 C	10 T	10 H	0.0	0.0	0.0	0.0	0.0	0.0	0.2
29 Chromium	155	0.0354	0.0085	0.0032	0.10	20,000	1,000	1,700 C	210 C	170,000 T	50 H	0.0	0.0	0.0	0.0	0.0	0.0	2.6
30 Copper	209	0.0478	0.0086	0.0032	0.23	600	1,000	18 C	12 C	-	1,300 PNR	0.0	0.0	0.0	0.0	NR	0.0	3.5
31 Cyanide	-	-	-	-	-	100	-	77 C	5.2 C	200 T	-	-	-	-	-	-	-	-
32 Lead	134	0.0306	0.0092	0.0038	0.13	100	1,000	81 C	3.2 C	50 T	50 H	0.0	0.0	0.0	0.0	0.0	0.0	2.2
33 Mercury	-	-	-	-	-	100	10	2.4 C	0.012 C	0.144 T	2 H	-	-	-	-	-	-	-
34 Nickel	89	0.0203	0.0136	0.0055	0.30	250	200	1,400 C	160 C	13.4 T	-	0.0	0.0	0.0	0.0	0.0	NR	1.5
36 Silver	1.0	0.0003	0.0001	0.0000	0.00	5,000	-	4.1 C	0.12 L	50 T	50 H	0.0	NR	0.0	0.0	0.0	0.0	0.0
38 Zinc	83150	19.0014	4.1403	1.3569	88.35	30	2,000	170 C	110 C	-	5,000 SW	0.6	0.0	0.0	0.0	NR	0.0	1,386.9
46 Chloronaphthalene, 2-	-	-	-	-	-	-	-	1,600 L	16 O	-	-	-	-	-	-	-	-	-
49 Dichloroethane	68	0.0158	0.0000	0.0003	0.01	100,000	-	193,000 L	9,630 O	0.19 C	-	0.0	NR	0.0	0.0	0.0	NR	1.1
50 Dichloroethene, 1,1-	157	0.0359	0.0047	0.0017	0.02	1,000	-	55,000 L	2,750 O	3,000 OT	-	0.0	NR	0.0	0.0	0.0	NR	2.6
60 Trichloroethane, 1,1,1-	615	0.1405	0.0176	0.0047	0.08	1,000	-	40,000 L	2,000 O	18,000 T	200 H	0.0	NR	0.0	0.0	0.0	0.0	10.3
67 Trichloroethene	-	-	-	-	-	20,000	-	18,000 L	2,700 L	2.7 C	5 H	-	-	-	-	-	-	-
68 Tetrachloroethene	-	-	-	-	-	20,000	-	5,290 L	840 L	0.80 C	-	-	-	-	-	-	-	-
87 Ethylbenzene	-	-	-	-	-	-	-	12,100 L	6,000 L	1,400 T	680 PNR	-	-	-	-	-	-	-
89 Toluene	-	-	-	-	-	-	-	13,000 L	630 O	14,300 T	2,000 PNR	-	-	-	-	-	-	-
92 Phenol	-	-	-	-	-	200,000	-	8,900 L	730 L	3,500 T	-	-	-	-	-	-	-	-
122 Naphthalene	-	-	-	-	-	500,000	-	2,300 L	620 L	6,000 OT	-	-	-	-	-	-	-	-
126 Pyrrolidine	2617	0.5980	0.0598	0.0223	[illegible]	5,000	-	2,300 L	175 O	0.00012 C	-	0.0	-	0.0	0.0	103.6 O	NR	63.7
135 Arsenic	20	0.0046	NR	-	NR	-	-	8,467 C	1,151 C	-	-	NR	-	-	-	-	-	0.8
137 Phosphorus	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	-
138 Iron	16,990	37.3829	NR	-	NR	-	-	-	1,000 C	-	300 SW	NR	-	-	-	-	-	2,727.2
139 Manganese	20100	[illegible]	NR	-	NR	-	-	950 C	150 C	-	-	NR	-	-	-	-	-	4,687.1
140 Sulfide	-	-	-	-	-	-	-	-	2 C	-	-	-	-	-	-	-	-	-
142 Manganese	2075	[illegible]	NR	-	NR	-	-	-	300 L	-	50 SW	NR	-	-	-	-	-	30.6
143 Barium	2275	0.5199	0.0520	0.0198	2.70	-	-	410,000 L	2,013 L	-	1,000 H	0.0	NR	0.0	0.0	NR	0.0	37.9
144 Cobalt	40.7	0.0093	NR	-	NR	-	-	1,620 L	38.2 L	-	-	NR	-	-	-	-	-	0.7
145 Fluoride	0.3	0.0001	NR	-	NR	-	-	1,600 L	-	-	4,000 SW	NR	-	-	-	-	-	0.0
146 Tin	470	0.1074	NR	-	NR	-	-	-	18.6 L	-	-	NR	-	-	-	-	-	7.0
147 Magnesium	95000	19.2939	NR	-	NR	-	-	-	357,000 L	-	-	NR	-	-	-	-	-	790.6
149 Titanium	3395	0.7590	NR	-	NR	-	-	-	191 L	-	-	NR	-	-	-	-	-	55.9
151 Molybdenum	0	0.0010	NR	-	NR	-	-	-	27.0 L	-	-	NR	-	-	-	-	-	0.1
154 Vanadium	213	0.0487	NR	-	NR	-	-	11,200 L	9 L	-	-	NR	-	-	-	-	-	3.6
155 Zirconium	-	-	-	-	-	-	-	-	10.3 L	-	-	-	-	-	-	-	-	-
160 Lithium	-	-	-	-	-	-	-	-	464 L	-	-	-	-	-	-	-	-	-
Boron	-	-	-	-	-	-	-	10,000 L	500 O	99,900 OT	-	-	-	-	-	-	-	-
Boron, B-	134	0.0306	NR	-	NR	-	-	-	31.6 L	-	-	NR	-	-	-	-	-	2.2
Boron, B-	-	-	-	-	-	-	-	10,000 L	1,300 L	-	-	-	-	-	-	-	-	-

ENVIRONMENTAL ANALYSIS FOR THE PAINT FORMULATING INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: [illegible]
LOW STREAM FLOW

PLANT FLOW (MGD): 0.008
STREAM FLOW (MGD): 59.0

POTW FLOW (MGD): 35.0
PLANT NO.: A

POLLUTANT NAME	CONCENTRATIONS (UG/L)					CRITERIA (UG/L)						CONCENTRATION/CRITERIA						POLLUTANT LOADING (LB/YR)
	DISCH	POTWINF	POTWEFF	SPOTWEFF	(SLUDGE)	IMM	SLUDGE	ACUTE	CHRONIC	HH-WQO	DWS	IMM	SLUDGE	ACUTE	CHRONIC	HH-WQO	DWS	
Diphenylamine	-	-	-	-	-	-	-	-	-	934 OT	-	-	-	-	-	-	-	-
Dodecane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eicosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lanthanum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl ethyl ketone	-	-	-	-	-	-	-	520,000 L	70,000 L	1,500 OT	-	-	-	-	-	-	-	-
Nondymium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octacosane, n-	2567	0.5866	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	42.8
Octadecane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Osmium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	-
Potassium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	23,000 L	6,800 L	-	140 PPM	-	-	-	-	-	-	-
Sulfur	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terpineol, alpha-	-	-	-	-	-	-	-	10,000 L	-	-	-	-	-	-	-	-	-	-
Tetracosane, n-	3400	0.7907	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	57.7
Yttrium	21	0.0048	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	0.4

[illegible] ANALYSIS FOR THE PAINT CONVERTING INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: [illegible]
LOW STREAM FLOW

PLANT FLOW (MGD): 0.0016
STREAM FLOW (MGD): 59.0

POTW FLOW (MGD): 35.0
PLANT NO.: 8

POLLUTANT NAME	CONCENTRATIONS (MG/L)					CRITERIA (MG/L)						CONCENTRATION/CRITERIA						POLLUTANT LOADING (LB/YR)
	BISON	POTWIN	POTWEFF	BPOTWEFF	(SLUDGE)	HH	SLUDGE	ACUTE	CHRONIC	HH-WFO	DWS	HH	SLUDGE	ACUTE	CHRONIC	HH-WFO	DWS	
10 DDT	-	-	-	-	-	-	-	1.1 C	0.001 C	0.000024 C	-	-	-	-	-	-	-	-
14 Endosulfan sulfate	-	-	-	-	-	-	-	0.22 C	0.056 C	74 T	-	-	-	-	-	-	-	-
15 Endrin	-	-	-	-	-	-	-	0.18 C	0.0023 C	1 T	0.2 H	-	-	-	-	-	-	-
19 Toxaphene	-	-	-	-	-	-	-	117,000 L	5,050 O	5,200 T	-	-	-	-	-	-	-	-
22 Antimony	-	-	-	-	-	-	-	9,000 L	1,600 L	146 T	-	-	-	-	-	-	-	-
23 Arsenic	83	0.0038	0.0023	0.0009	0.01	100	-	360 C	190 C	0.0022 C	50 H	0.0	NA	0.0	0.0	0.0	0.0	0.3
25 Beryllium	3	0.0001	NA	-	0.00	-	-	130 L	5.3 L	0.0068 C	-	NA	-	-	-	-	-	0.0
26 Cadmium	-	-	-	-	-	20	20	3.9 C	1.1 C	10 T	10 H	-	-	-	-	-	-	-
29 Chromium	110	0.0050	0.0012	0.0004	0.02	10,000	1,000	1,700 C	210 C	170,000 T	50 H	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30 Copper	320	0.0146	0.0026	0.0010	0.07	400	1,000	18 C	12 C	-	1,300 PMN	0.0	0.0	0.0	0.0	NA	0.0	1.1
31 Cyanide	-	-	-	-	-	100	-	22 C	5.2 C	200 T	-	-	-	-	-	-	-	-
32 Lead	53	0.0024	0.0007	0.0003	0.00	100	1,000	83 C	3.2 C	50 T	50 H	0.0	0.0	0.0	0.0	0.0	0.0	0.2
33 Mercury	-	-	-	-	-	100	10	2.4 C	0.012 C	0.144 T	2 H	-	-	-	-	-	-	-
34 Nickel	110	0.0050	0.0034	0.0013	0.00	250	200	1,400 C	160 C	13.4 T	-	0.0	0.0	0.0	0.0	0.0	NA	0.0
36 Silver	-	-	-	-	-	5,000	-	4.1 C	0.12 C	50 T	50 H	-	-	-	-	-	-	-
38 Zinc	3400	0.1554	0.0342	0.0127	0.72	30	2,000	120 C	110 C	-	5,000 SM	0.0	0.0	0.0	0.0	NA	0.0	11.3
46 Chloronaphthalene, 2-	8120	0.3712	0.0186	0.0069	0.75	-	-	1,600 L	16 O	-	-	NA	NA	0.0	0.0	NA	NA	27.1
49 Dichloroethane	-	-	-	-	-	100,000	-	193,000 L	9,650 O	0.19 C	-	-	-	-	-	-	-	-
50 Dichloroethane, 1,1-	-	-	-	-	-	1,000	-	55,000 L	2,750 O	3,000 OT	-	-	-	-	-	-	-	-
60 Trichloroethane, 1,1,1-	-	-	-	-	-	1,000	-	40,000 L	2,000 O	18,400 T	200 H	-	-	-	-	-	-	-
67 Trichloroethene	-	-	-	-	-	20,000	-	18,000 L	2,200 L	2.7 C	5 H	-	-	-	-	-	-	-
68 Tetrachloroethene	-	-	-	-	-	20,000	-	5,290 L	840 L	0.80 C	-	-	-	-	-	-	-	-
87 Ethylbenzene	-	-	-	-	-	-	-	17,100 L	6,800 L	1,400 T	680 PMN	-	-	-	-	-	-	-
89 Toluene	-	-	-	-	-	-	-	13,000 L	650 O	14,300 T	2,000 PMN	-	-	-	-	-	-	-
92 Phenol	-	-	-	-	-	200,000	-	8,900 L	750 L	3,500 T	-	-	-	-	-	-	-	-
122 Naphthalene	8053	0.3681	0.0368	0.0137	0.32	500,000	-	2,300 L	620 L	6,600 OT	-	0.0	NA	0.0	0.0	0.0	NA	96.9
128 Benzidine	-	-	-	-	-	5,000	-	2,500 L	125 O	0.00012 C	-	-	-	-	-	-	-	-
135 Ammonia	25	0.0011	NA	-	NA	-	-	8,467 C	1,151 C	-	-	NA	-	-	-	-	-	0.1
137 Phosphorus	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	-
138 Iron	140000	6.3997	NA	-	NA	-	-	-	1,000 C	-	300 SM	NA	-	-	-	-	-	467.0
139 Aluminum	230000	10.5138	NA	-	NA	-	-	950 C	150 C	-	-	NA	-	-	-	-	-	767.3
140 Sulfide	1.6	0.0001	NA	-	NA	-	-	-	2 C	-	-	NA	-	-	-	-	-	0.0
142 Manganese	9160	0.4160	NA	-	NA	-	-	-	300 L	-	50 SM	NA	-	-	-	-	-	30.4
143 Barium	2300	0.1051	0.0105	0.0039	0.56	-	-	410,000 L	2,013 L	-	1,000 H	NA	NA	0.0	0.0	NA	0.0	7.7
144 Cobalt	37	0.0016	NA	-	NA	-	-	1,620 L	38.2 L	-	-	NA	-	-	-	-	-	0.1
145 Fluoride	-	-	-	-	-	-	-	1,600 L	-	-	4,000 SM	-	-	-	-	-	-	-
146 Tin	850	0.0116	NA	-	NA	-	-	-	18.6 L	-	-	NA	-	-	-	-	-	0.0
147 Magnesium	31000	1.4171	NA	-	NA	-	-	-	367,600 L	-	-	NA	-	-	-	-	-	103.4
149 Titanium	8500	0.4058	NA	-	NA	-	-	-	191 L	-	-	NA	-	-	-	-	-	59.7
151 Molybdenum	15	0.0007	NA	-	NA	-	-	-	27.8 L	-	-	NA	-	-	-	-	-	0.1
154 Vanadium	190	0.0087	NA	-	NA	-	-	11,200 L	9 L	-	-	NA	-	-	-	-	-	0.6
156 Zirconium	-	-	-	-	-	-	-	-	10.3 L	-	-	-	-	-	-	-	-	-
160 Lithium	-	-	-	-	-	-	-	-	464 L	-	-	-	-	-	-	-	-	-
Acetone	-	-	-	-	-	-	-	10,000 L	500 O	99,900 OT	-	-	-	-	-	-	-	-
Boron	87	0.0040	NA	-	NA	-	-	-	31.6 L	-	-	NA	-	-	-	-	-	0.3
Decane, n-	12069	0.5517	NA	-	NA	-	-	18,000 L	1,300 L	-	-	NA	-	-	-	-	-	40.3

[illegible] FOR THE PAINT FORMULATING INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: [illegible]
LOW STRENGTH FLOW

PLANT FLOW (MGD): 0.0016
STRENGTH FLOW (MGD): 57.0

PROC FLOW (MGD): 35.0
PLANT NO.: 8

POLLUTANT NAME	CONCENTRATION (MG/L) BISCP	POTWNF	POTWTT	BPCTWTT	BPCTBAT	CRITERIA (MG/L) INH	SLUDGE	ACUTE	CHRONIC	HH-ORG	BAS	CONCENTRATION/CRITERIA INH	SLUDGE	ACUTE	CHRONIC	HH-ORG	BAS	POLLUTANT LOADING (LB/YR)
Diphenylamine	15330	0.7011	0.0701	0.0561	[illegible]	-	-	-	-	934 PT	-	NA	NA	NA	NA	0.0	NA	51.2
Dodecane, n-	7642	0.3493	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	25.5
Eicosane, n-	3857	0.1763	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	12.9
Ethanol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethyl ethyl ketone	-	-	-	-	-	-	-	520,000 L	70,000 L	1,300 PT	-	-	-	-	-	-	-	-
Hexadecane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octacosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octadecane, n-	4621	0.2112	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	15.4
Oxalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	-
Potassium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	23,000 L	6,800 L	-	140 PWR	-	-	-	-	-	-	-
Sulfur	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terpinol, alpha-	1029	0.0470	NA	-	NA	-	-	10,000 L	-	-	-	NA	-	-	-	-	-	3.4
Tetracosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yttrium	25	0.0011	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	0.1

ENVIRONMENTAL ANALYSIS FOR THE PAINT FORMULATING INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: BPT
LOW STREAM FLOW

PLANT FLOW (MGD): 0.001
STREAM FLOW (MGD): 39.0

POTW FLOW (MGD): 35.0
PLANT NO.: 8

POLLUTANT NAME	CONCENTRATIONS (UG/L) BPCTA	BPCTUNG	BPCTBTT	BPCTBTT	BPCTBAT	CRITERIA (UG/L) HUM	SLUDGE	ACUTE	CHRONIC	NON-HUM	HUM	CONCENTRATION/CRITERIA HUM	SLUDGE	ACUTE	CHRONIC	NON-HUM	HUM	POLLUTANT LOADING (LB/YR)
10 DDT	-	-	-	-	-	-	-	1.1 C	0.001 C	0.000024 C	-	-	-	-	-	-	-	-
14 Endosulfan sulfate	-	-	-	-	-	-	-	0.22 C	0.056 C	74 T	-	-	-	-	-	-	-	-
15 Endrin	-	-	-	-	-	-	-	0.18 C	0.0023 C	1 T	0.2 W	-	-	-	-	-	-	-
17 Isophorone	3050	0.0083	NR	-	NR	-	-	117,000 L	5,850 O	5,200 T	-	NR	-	-	-	-	-	6.6
22 Delisoxy	-	-	-	-	-	-	-	9,000 L	1,600 L	146 T	-	-	-	-	-	-	-	-
23 Arsenic	-	-	-	-	-	100	-	360 C	190 C	0.0022 C	50 W	-	-	-	-	-	-	-
25 Beryllium	-	-	-	-	-	-	-	130 L	5.3 L	0.0068 C	-	-	-	-	-	-	-	-
26 Cadmium	217	0.0062	0.0024	0.0009	0.02	10	20	3.9 C	1.1 C	10 T	10 W	0.0	0.0	0.0	0.0	0.0	0.0	0.5
27 Chromium	822	0.0235	0.0076	0.0021	0.11	10,000	1,000	1,700 C	210 C	170,000 T	50 W	0.0	0.0	0.0	0.0	0.0	0.0	1.7
30 Copper	313	0.0089	0.0016	0.0006	0.04	400	1,000	18 C	12 C	-	1,300 PWS	0.0	0.0	0.0	0.0	NR	0.0	0.7
31 Cyanide	0.11	0.0000	0.0000	0.0000	0.00	100	-	22 C	5.2 C	200 T	-	0.0	NR	0.0	0.0	0.0	NR	0.0
32 Lead	1030	0.0523	0.0137	0.0058	0.22	100	1,000	83 C	3.2 C	50 T	50 W	0.0	0.0	0.0	0.0	0.0	0.0	3.0
33 Mercury	3500	0.1000	0.0400	0.0149	0.25	100	10	2.4 C	0.012 C	0.144 T	2 W	0.0	0.0	0.0	1.2 *	0.1	0.0	7.3
34 Nickel	-	-	-	-	-	250	200	1,400 C	160 C	13.4 T	-	-	-	-	-	-	-	-
36 Silver	-	-	-	-	-	5,000	-	4.1 C	0.12 L	50 T	50 W	-	-	-	-	-	-	-
38 Zinc	843000	24.0850	5.2987	1.9734	111.97	30	2,000	120 C	110 C	-	5,000 SW	0.0	0.1	0.0	0.0	NR	0.0	1,757.7
46 Chloronaphthalene, 2-	-	-	-	-	-	-	-	1,600 L	16 O	-	-	-	-	-	-	-	-	-
49 Dichloroethane	-	-	-	-	-	100,000	-	193,000 L	9,650 O	0.19 C	-	-	-	-	-	-	-	-
50 Dichloroethene, 1,1-	-	-	-	-	-	1,000	-	55,000 L	2,750 O	3,000 OT	-	-	-	-	-	-	-	-
60 Trichloroethane, 1,1,1-	1446	0.0413	0.0037	0.0014	0.02	1,000	-	40,000 L	2,000 O	18,400 T	200 W	0.0	NR	0.0	0.0	0.0	0.0	3.0
67 Trichloroethene	373	0.0107	0.0005	0.0002	0.00	20,000	-	18,000 L	2,700 L	2.7 C	5 W	0.0	NR	0.0	0.0	0.0	0.0	0.0
68 Tetrachloroethene	1092	0.0312	0.0031	0.0012	0.03	20,000	-	5,280 L	840 L	0.80 C	-	0.0	NR	0.0	0.0	0.0	NR	2.3
87 Ethylbenzene	119106	3.4052	0.1703	0.0634	2.05	-	-	12,100 L	6,800 L	1,400 T	680 PWS	NR	NR	0.0	0.0	0.0	0.0	290.5
89 Toluene	105793	2.8797	0.0864	0.0322	4.99	-	-	13,000 L	630 O	14,300 T	2,000 PWS	NR	NR	0.0	0.0	0.0	0.0	210.2
92 Phenol	-	-	-	-	-	200,000	-	8,900 L	750 L	3,500 T	-	-	-	-	-	-	-	-
122 Naphthalene	4696	0.1342	0.0134	0.0050	0.12	300,000	-	2,300 L	620 L	6,800 OT	-	0.0	NR	0.0	0.0	0.0	NR	9.0
128 Benzidine	-	-	-	-	-	5,000	-	2,500 L	125 O	0.00012 C	-	-	-	-	-	-	-	-
135 Ammonia	63	0.0018	NR	-	NR	-	-	8,467 C	1,151 C	-	-	NR	-	-	-	-	-	0.1
137 Phosphorus	7	0.0002	NR	-	NR	-	-	2 L	-	-	-	NR	-	-	-	-	-	0.0
138 Iron	14400	0.4114	NR	-	NR	-	-	-	1,000 C	-	300 SW	NR	-	-	-	-	-	30.0
139 Manganese	135000	3.8570	NR	-	NR	-	-	950 C	150 C	-	-	NR	-	-	-	-	-	201.5
140 Sulfide	-	-	-	-	-	-	-	-	2 C	-	-	-	-	-	-	-	-	-
142 Manganese	795	0.0227	NR	-	NR	-	-	-	300 L	-	50 NR	NR	-	-	-	-	-	1.7
143 Barium	3780	0.1080	0.0108	0.0040	0.50	-	-	410,000 L	2,013 L	-	1,000 W	NR	NR	0.0	0.0	NR	0.0	7.9
144 Cobalt	1670	0.0477	NR	-	NR	-	-	1,420 L	38.2 L	-	-	NR	-	-	-	-	-	3.5
145 Fluoride	-	-	-	-	-	-	-	1,600 L	-	-	4,000 SW	-	-	-	-	-	-	-
146 Tin	481	0.0137	NR	-	NR	-	-	-	18.6 L	-	-	NR	-	-	-	-	-	1.0
147 Magnesium	21800	0.6228	NR	-	NR	-	-	-	367,600 L	-	-	NR	-	-	-	-	-	85.5
149 Titanium	2970	0.0849	NR	-	NR	-	-	-	191 L	-	-	NR	-	-	-	-	-	6.2
151 Molybdenum	-	-	-	-	-	-	-	-	27.8 L	-	-	-	-	-	-	-	-	-
154 Vanadium	79	0.0021	NR	-	NR	-	-	11,200 L	9 L	-	-	NR	-	-	-	-	-	0.2
156 Zirconium	0.3	0.0008	NR	-	NR	-	-	-	10.3 L	-	-	NR	-	-	-	-	-	0.0
160 Lithium	0.1	0.0000	NR	-	NR	-	-	-	464 L	-	-	NR	-	-	-	-	-	0.0
Acetone	1956,300	55.3379	2.7519	1.0049	31.10	-	-	10,000 L	500 O	99,900 OT	-	NR	NR	0.0	0.0	0.0	NR	4,016.5
Boron	1400	0.0400	NR	-	NR	-	-	-	31.6 L	-	-	NR	-	-	-	-	-	2.9
Bromo, 3-	-	-	-	-	-	-	-	18,000 L	1,300 L	-	-	-	-	-	-	-	-	-

[illegible] ANALYSIS FOR THE PAINT FORMULATING INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: [illegible]
LOW STREAM FLOW

PLANT FLOW (MGD): 0.001
STREAM FLOW (MGD): 59.0

POTW FLOW (MGD): 25.0
PLANT NO.: 8

POLLUTANT NAME	CONCENTRATIONS (MG/L)					CRITERIA (MG/L)						CONCENTRATION/CRITERIA						POLLUTANT LOADING (LB/YR)
	DISCH	POTWIN	POTWOUT	DRINKT	FISH/SHELL	FISH	SLUDGE	ACUTE	CHRONIC	NON-HUM	DRS	FISH	SLUDGE	ACUTE	CHRONIC	NON-HUM	DRS	
Diphenylamine	-	-	-	-	-	-	-	-	-	934 PT	-	-	-	-	-	-	-	-
Dodecane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eicosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lanthanum	0.1	0.0000	NR	-	NR	-	-	-	-	-	-	NR	-	-	-	-	-	0.0
Methyl ethyl ketone	-	-	-	-	-	-	-	520,000 L	70,000 L	1,500 PT	-	-	-	-	-	-	-	-
Naphthalene	0.5	0.0000	NR	-	NR	-	-	-	-	-	-	NR	-	-	-	-	-	0.0
Octacosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octadecane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxalate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	-
Potassium	5	0.0001	NR	-	NR	-	-	-	-	-	-	NR	-	-	-	-	-	0.0
Strontium	4	0.0001	NR	-	NR	-	-	-	-	-	-	NR	-	-	-	-	-	0.0
Styrene	-	-	-	-	-	-	-	23,000 L	6,000 L	-	140 MGN	-	-	-	-	-	-	-
Sulfur	126	0.0036	NR	-	NR	-	-	-	-	-	-	NR	-	-	-	-	-	0.3
Terpinol, alpha-	-	-	-	-	-	-	-	10,000 L	-	-	-	-	-	-	-	-	-	-
Tetracosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yttrium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

INTRODUCTORY ANALYSIS FOR THE PAINT FORMULATING INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: BAT
LOW STATION FLOW

PLANT FLOW (MGD): 0.002
STATION FLOW (MGD): 39.0

PATH FLOW (MGD): 35.0
PLANT NO.: E

POLLUTANT NAME	CONCENTRATIONS (MG/L) BIOCH	PONDING	POTWTT	DPOTWTT	(BLANKS)	CRITERIA (MG/L) FWA	SLEWAT	ACUTE	CHRONIC	HH-WQC	DWS	CONCENTRATION/CRITERIA FWA	SLEWAT	ACUTE	CHRONIC	HH-WQC	DWS	POLLUTANT LOADING (LB/DA)
10 BOD	2	0.0001	NA	-	NA	-	-	1.1 C	0.001 C	0.000024 C	-	NA	-	-	-	-	-	0.0
14 Endosulfan sulfate	1130	0.0046	NA	-	NA	-	-	0.22 C	0.056 C	74 T	-	NA	-	-	-	-	-	0.7
15 Endrin	110	0.0063	0.0003	0.0001	0.01	-	-	0.18 C	0.0023 C	1 T	0.2 H	NA	NA	0.0	0.1	0.0	0.0	0.5
17 Lindane	-	-	-	-	-	-	-	117,000 L	5,050 O	5,200 T	-	-	-	-	-	-	-	-
22 Antimony	-	-	-	-	-	-	-	9,000 L	1,600 L	146 T	-	-	-	-	-	-	-	-
23 Arsenic	50	0.0033	0.0020	0.0008	0.01	100	-	360 C	190 C	0.0022 C	50 H	0.0	NA	0.0	0.0	0.3	0.0	0.2
25 Beryllium	-	-	-	-	-	-	-	130 L	5.3 L	0.0068 C	-	-	-	-	-	-	-	-
26 Cadmium	30	0.0017	0.0007	0.0002	0.01	20	20	3.9 C	1.1 C	10 T	10 H	0.0	0.0	0.0	0.0	0.0	0.0	0.1
29 Chromium	6620	0.2640	0.0634	0.0236	1.00	10,000	1,000	1,700 C	210 C	170,000 T	50 H	0.0	0.0	0.0	0.0	0.0	0.0	19.3
30 Copper	50	0.0033	0.0006	0.0002	0.02	400	1,000	18 C	12 C	-	1,300 PWS	0.0	0.0	0.0	0.0	NA	0.0	0.2
31 Cyanide	-	-	-	-	-	100	-	22 C	5.2 C	200 T	-	-	-	-	-	-	-	-
32 Lead	122	0.0070	0.0021	0.0008	0.03	100	1,000	83 C	3.2 C	50 T	50 H	0.0	0.0	0.0	0.0	0.0	0.0	0.5
33 Mercury	-	-	-	-	-	100	10	2.4 C	0.012 C	0.144 T	2 H	-	-	-	-	-	-	-
34 Nickel	44	0.0025	0.0017	0.0006	0.03	250	200	1,400 C	160 C	13.4 T	-	0.0	0.0	0.0	0.0	0.0	NA	0.2
35 Silver	-	-	-	-	-	5,000	-	4.1 C	0.12 L	50 T	50 H	-	-	-	-	-	-	-
38 Zinc	3390	0.1937	0.0426	0.0159	0.50	30	2,000	120 C	110 C	-	5,000 SW	0.0	0.0	0.0	0.0	NA	0.0	14.1
46 Chloronaphthalene, 2-	-	-	-	-	-	-	-	1,600 L	16 O	-	-	-	-	-	-	-	-	-
59 Dichlorobenzene	481612	27.5191	1.3760	0.5125	15.50	400,000	-	193,000 L	9,650 O	0.19 C	-	0.0	NA	0.0	0.0	2.7 O	NA	2,000.3
58 Dichlorobenzene, 1,1-	-	-	-	-	-	1,000	-	55,000 L	2,750 O	3,000 OT	-	-	-	-	-	-	-	-
60 Trichlorobenzene, 1,1,1-	-	-	-	-	-	1,000	-	40,000 L	2,000 O	18,400 T	200 H	-	-	-	-	-	-	-
67 Trichlorobenzene	-	-	-	-	-	20,000	-	18,000 L	2,200 L	2.7 C	5 H	-	-	-	-	-	-	-
68 Tetrachlorobenzene	-	-	-	-	-	20,000	-	5,200 L	840 L	0.80 C	-	-	-	-	-	-	-	-
87 Ethylbenzene	2183	0.1207	0.0062	0.0003	0.10	-	-	17,100 L	6,800 L	1,400 T	680 PWS	NA	NA	0.0	0.0	0.0	0.0	9.1
89 Toluene	621	0.0355	0.0011	0.0004	0.06	-	-	13,000 L	630 O	14,300 T	2,000 PWS	NA	NA	0.0	0.0	0.0	0.0	2.6
92 Phenol	1810	0.1039	0.0021	0.0008	0.06	200,000	-	8,900 L	750 L	3,500 T	-	0.0	NA	0.0	0.0	0.0	NA	7.6
122 Naphthalene	-	-	-	-	-	500,000	-	2,300 L	620 L	6,800 OT	-	-	-	-	-	-	-	-
128 Benzidine	-	-	-	-	-	5,000	-	2,500 L	125 O	0.00012 C	-	-	-	-	-	-	-	-
135 Anthracene	61	0.0035	NA	-	NA	-	-	8,467 C	1,151 C	-	-	NA	-	-	-	-	-	-
137 Phosphorus	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	0.3
138 Iron	104000	5.9925	NA	-	NA	-	-	-	1,000 C	-	300 SW	NA	-	-	-	-	-	-
139 Aluminum	840	0.0480	NA	-	NA	-	-	950 C	150 C	-	-	NA	-	-	-	-	-	433.7
140 Sulfide	-	-	-	-	-	-	-	-	2 C	-	-	-	-	-	-	-	-	3.5
142 Manganese	1100	0.0629	NA	-	NA	-	-	-	300 L	-	50 SW	NA	-	-	-	-	-	-
143 Barium	1260	0.0720	0.0072	0.0027	0.39	-	-	410,000 L	2,013 L	-	1,000 H	NA	NA	0.0	0.0	NA	0.0	0.6
144 Cobalt	330	0.0191	NA	-	NA	-	-	1,620 L	38.2 L	-	-	NA	-	-	-	-	-	5.3
145 Fluoride	0.5	0.0000	NA	-	NA	-	-	1,600 L	-	-	4,000 SW	NA	-	-	-	-	-	1.4
146 Tin	-	-	-	-	-	-	-	-	18.6 L	-	-	-	-	-	-	-	-	0.0
147 Magnesium	24000	1.4256	NA	-	NA	-	-	-	367,600 L	-	-	NA	-	-	-	-	-	-
149 Titanium	.35	0.0021	NA	-	NA	-	-	-	191 L	-	-	NA	-	-	-	-	-	108.4
151 Molybdenum	-	-	-	-	-	-	-	-	27.8 L	-	-	-	-	-	-	-	-	0.2
154 Vanadium	-	-	-	-	-	-	-	11,700 L	9 L	-	-	-	-	-	-	-	-	-
156 Zirconium	-	-	-	-	-	-	-	-	10.3 L	-	-	-	-	-	-	-	-	-
160 Lithium	-	-	-	-	-	-	-	-	464 L	-	-	-	-	-	-	-	-	-
Boehmite	4576	0.2615	0.0131	0.0049	0.15	-	-	10,000 L	500 O	99,900 OT	-	NA	NA	0.0	0.0	0.0	NA	19.1
Boron	210	0.0120	NA	-	NA	-	-	-	31.6 L	-	-	NA	-	-	-	-	-	0.9
Bromo, n-	-	-	-	-	-	-	-	10,000 L	1,300 L	-	-	-	-	-	-	-	-	-

CONTINUATION ANALYSIS FOR THE PAINT FORMULATING INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: BAT
LOW STREAM FLOW

PLANT FLOW (MGD): 0.042
STREAM FLOW (MGD): 59.0

POTW FLOW (MGD): 35.0
PLANT NO.: E

POLLUTANT NAME	CONCENTRATIONS (MG/L)					CRITERIA (MG/L)						CONCENTRATION/CRITERIA						POLLUTANT LOADING (LB/YR)
	BIOTA	PRIMARY	PRIMARY	SECONDARY	SECONDARY	FISH	SLUDGE	ACUTE	CHRONIC	NON-POT	POTW	FISH	SLUDGE	ACUTE	CHRONIC	NON-POT	POTW	
Diphenylamine	-	-	-	-	-	-	-	-	-	934 PT	-	-	-	-	-	-	-	-
Dodecane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eicosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethanone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethyl ethyl ketone	119736	0.0017	0.3421	0.1274	3.07	-	-	520,000 L	70,000 L	1,500 PT	-	NO	NO	0.0	0.0	0.0	NO	999.3
Hendyolue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octanone, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octadecane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ozone	170	0.0097	NO	-	NO	-	-	-	-	-	-	NO	-	-	-	-	-	0.7
Phenol	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	-
Potassium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	13300	0.7500	NO	-	NO	-	-	-	-	-	-	NO	-	-	-	-	-	55.5
Styrene	2329	0.1331	NO	-	NO	-	-	23,000 L	6,800 L	-	140 PPM	NO	-	-	-	-	-	9.7
Sulfur	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terpinol, alpha-	-	-	-	-	-	-	-	10,000 L	-	-	-	-	-	-	-	-	-	-
Tetracosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yttrium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

APPENDIX E

POTW MODEL RESULTS USING 25TH PERCENTILE POTW AND RECEIVING STREAM FLOWS

ENVIRONMENTAL ANALYSIS FOR THE POINT CONSOLIDATING INDUSTRY
INDIRECT DISCHARGERS

DISCHARGE LEVEL: [illegible]
LOW DISCHARGE FLOW

PLANT FLOW (MGD): 0.000
DISCHARGE FLOW (MGD): 37.6

POTW FLOW (MGD): 0.0
PLANT NO.: 0

POLLUTANT NAME	CONCENTRATIONS (UG/L)					CRITERIA (UG/L)						CONCENTRATION/CRITERIA						POLLUTANT LOADING (LB/YR)
	BISON	POTWW	POTWTT	BPOTWTT	(SLUDGE)	HUM	SLUDGE	ACUTE	CHRONIC	NON-HUM	DWS	HUM	SLUDGE	ACUTE	CHRONIC	NON-HUM	DWS	
10 DDT	-	-	-	-	-	-	-	1.1 C	0.001 C	0.000024 C	-	-	-	-	-	-	-	-
14 Endosulfan sulfate	-	-	-	-	-	-	-	0.22 C	0.056 C	74 T	-	-	-	-	-	-	-	-
15 Endrin	-	-	-	-	-	-	-	0.18 C	0.0023 C	1 T	0.2 H	-	-	-	-	-	-	-
19 Isophorone	-	-	-	-	-	-	-	117,000 L	5,850 O	5,200 T	-	-	-	-	-	-	-	-
22 Antimony	191	0.1885	0.0041	0.0129	0.19	-	-	9,000 L	1,600 L	146 T	-	NA	NA	0.0	0.0	0.0	NA	3.2
23 Arsenic	-	-	-	-	-	100	-	360 C	190 C	0.0022 C	50 M	-	-	-	-	-	-	-
25 Beryllium	1.4	0.0014	NA	-	0.00	-	-	130 L	5.3 L	0.0068 C	-	NA	-	-	-	-	-	0.0
26 Cadmium	11	0.0109	0.0042	0.0008	0.01	20	20	3.9 C	1.1 C	10 T	10 M	0.0	0.0	0.0	0.0	0.0	0.0	0.2
29 Chromium	155	0.1579	0.0367	0.0073	0.09	10,000	1,000	1,700 C	210 C	170,000 T	50 M	0.0	0.0	0.0	0.0	0.0	0.0	2.6
30 Copper	209	0.2062	0.0371	0.0074	1.01	460	1,000	18 C	12 C	-	1,300 PMN	0.0	0.0	0.0	0.0	NA	0.0	3.5
31 Cyanide	-	-	-	-	-	100	-	22 C	5.2 C	200 T	-	-	-	-	-	-	-	-
32 Lead	134	0.1322	0.0397	0.0079	0.55	100	1,000	83 C	3.2 C	50 T	50 M	0.0	0.0	0.0	0.0	0.0	0.0	2.2
33 Mercury	-	-	-	-	-	100	10	2.4 C	0.012 C	0.144 T	2 M	-	-	-	-	-	-	-
34 Nickel	89	0.0878	0.0588	0.0117	0.17	250	200	1,400 C	160 C	13.4 T	-	0.0	0.0	0.0	0.0	0.0	NA	1.5
36 Silver	1.4	0.0014	0.0003	0.0001	0.01	5,000	-	4.1 C	0.12 L	50 T	50 M	0.0	NA	0.0	0.0	0.0	0.0	0.0
38 Zinc	83150	82.0424	18.0493	3.5756	381.44	30	2,000	129 C	110 C	-	5,000 SM	2.7 O	0.2	0.2	0.0	NA	0.0	1,396.9
46 Chloronaphthalene, 2-	-	-	-	-	-	-	-	1,600 L	16 O	-	-	-	-	-	-	-	-	-
49 Dichloroethane	68	0.0671	0.0030	0.0007	0.00	100,000	-	193,000 L	9,630 O	0.19 C	-	0.0	NA	0.0	0.0	0.0	NA	1.1
50 Dichloroethane, 1,1-	157	0.1549	0.0201	0.0040	0.07	1,000	-	55,000 L	2,750 O	3,000 OT	-	0.0	NA	0.0	0.0	0.0	NA	2.6
60 Trichloroethane, 1,1,1-	615	0.6068	0.0546	0.0109	0.33	1,000	-	40,000 L	2,000 O	18,400 T	200 M	0.0	NA	0.0	0.0	0.0	0.0	10.3
67 Trichloroethene	-	-	-	-	-	20,000	-	18,000 L	2,700 L	2.7 C	5 M	-	-	-	-	-	-	-
68 Tetrachloroethene	-	-	-	-	-	20,000	-	5,280 L	840 L	0.80 C	-	-	-	-	-	-	-	-
87 Ethylbenzene	-	-	-	-	-	-	-	12,100 L	6,800 L	1,050 T	680 PMN	-	-	-	-	-	-	-
89 Toluene	-	-	-	-	-	-	-	13,000 L	650 O	14,300 T	2,000 PMN	-	-	-	-	-	-	-
92 Phenol	-	-	-	-	-	200,000	-	8,900 L	750 L	3,500 T	-	-	-	-	-	-	-	-
122 Naphthalene	-	-	-	-	-	500,000	-	2,300 L	620 L	6,800 OT	-	-	-	-	-	-	-	-
120 Benzidine	2617	2.5821	0.2582	0.0514	NA	5,000	-	2,500 L	125 O	0.00012 C	-	0.0	-	0.0	0.0	020.7 O	NA	43.7
135 Anthracene	20	0.0197	NA	-	NA	-	-	8,467 C	1,151 C	-	-	NA	-	-	-	-	-	0.3
137 Phosphorus	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	-
138 Iron	16.3500	161.3222	NA	-	NA	-	-	-	1,000 C	-	300 SM	NA	-	-	-	-	-	2,727.2
139 Aluminum	281000	277.2570	NA	-	NA	-	-	950 C	150 C	-	-	NA	-	-	-	-	-	4,687.1
140 Sulfide	-	-	-	-	-	-	-	-	2 C	-	-	-	-	-	-	-	-	-
142 Manganese	2075	2.0474	NA	-	NA	-	-	-	300 L	-	50 SM	NA	-	-	-	-	-	34.6
143 Barium	2275	2.2447	0.2245	0.0447	12.00	-	-	410,000 L	2,013 L	-	1,000 M	NA	NA	0.0	0.0	NA	0.0	37.9
144 Cobalt	40.7	0.0402	NA	-	NA	-	-	1,620 L	38.2 L	-	-	NA	-	-	-	-	-	0.7
145 Fluoride	0.3	0.0003	NA	-	NA	-	-	1,600 L	-	-	4,000 SM	NA	-	-	-	-	-	0.0
146 Tin	470	0.4637	NA	-	NA	-	-	-	18.6 L	-	-	NA	-	-	-	-	-	7.8
147 Magnesium	45000	44.4006	NA	-	NA	-	-	-	387,600 L	-	-	NA	-	-	-	-	-	750.6
149 Titanium	3375	3.2907	NA	-	NA	-	-	-	191 L	-	-	NA	-	-	-	-	-	55.5
151 Molybdenum	0	0.0079	NA	-	NA	-	-	-	27.8 L	-	-	NA	-	-	-	-	-	0.1
150 Vanadium	213	0.2102	NA	-	NA	-	-	11,200 L	9 L	-	-	NA	-	-	-	-	-	3.6
156 Zirconium	-	-	-	-	-	-	-	-	10.3 L	-	-	-	-	-	-	-	-	-
160 Lithium	-	-	-	-	-	-	-	-	464 L	-	-	-	-	-	-	-	-	-
Boron	-	-	-	-	-	-	-	10,000 L	500 O	99,900 OT	-	-	-	-	-	-	-	-
Boron, B-	134	0.1322	NA	-	NA	-	-	-	31.6 L	-	-	NA	-	-	-	-	-	2.2
Boron, B-	-	-	-	-	-	-	-	10,000 L	1,300 L	-	-	-	-	-	-	-	-	-

CONTINUATION ANALYSIS FOR THE PAINT FORMULATING INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: [illegible]
LOW STREAM FLOW

PLANT FLOW (MGD): 0.008
STREAM FLOW (MGD): 32.6

POTW FLOW (MGD): 0.1
PLANT NO.: 8

POLLUTANT NAME	CONCENTRATION (UG/L)					CRITERIA (UG/L)						CONCENTRATION/CRITERIA						POLLUTANT LOADING (LB/YR)
	BTCH	POTWF	POTWTF	BPOTWTF	(BLDRE)	FAH	SLDRE	ACUTE	CHRONIC	HH-ORG	DWS	FAH	SLDRE	ACUTE	CHRONIC	HH-ORG	DWS	
Diphenylamine	-	-	-	-	-	-	-	-	-	934 PT	-	-	-	-	-	-	-	-
Dodecane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eicosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethanol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethyl vinyl ketone	-	-	-	-	-	-	-	520,000 L	70,000 L	1,300 PT	-	-	-	-	-	-	-	-
Hydrazine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octacosane, n-	2567	2.1329	NR	-	NR	-	-	-	-	-	-	-	-	-	-	-	-	-
Octadecane, n-	-	-	-	-	-	-	-	-	-	-	-	NR	-	-	-	-	-	42.8
Ozone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	-
Strontium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfur	-	-	-	-	-	-	-	23,000 L	6,000 L	-	140 DWS	-	-	-	-	-	-	-
Terpineol, alpha-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetracosane, n-	3460	2.4139	NR	-	NR	-	-	10,000 L	-	-	-	-	-	-	-	-	-	-
Yttrium	21	0.0207	NR	-	NR	-	-	-	-	-	-	NR	-	-	-	-	-	57.7
												NR	-	-	-	-	-	0.4

ENVIRONMENTAL ANALYSIS FOR THE POINT GENERATING INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: NONE
LOW STREAM FLOW

PLANT FLOW (MGD): 0.0016
STREAM FLOW (MGD): 32.6

POTW FLOW (MGD): 0.1
PLANT NO.: 9

POLLUTANT NAME	CONCENTRATIONS (UG/L) RIVER	POTWTP	POTWTT	POTWTT	POTWTT (POUNDS/D)	CRITERIA (UG/L) FWA	SLUDGE	ACUTE	CHRONIC	HH-ORG	DWS	CONCENTRATION/CRITERIA FWA	SLUDGE	ACUTE	CHRONIC	HH-ORG	DWS	POLLUTANT LOADING (LB/YR)
10 DDT	-	-	-	-	-	-	-	1.1 C	0.001 C	0.000024 C	-	-	-	-	-	-	-	-
14 Endosulfan sulfate	-	-	-	-	-	-	-	0.22 C	0.056 C	74 T	-	-	-	-	-	-	-	-
15 Endrin	-	-	-	-	-	-	-	0.18 C	0.0023 C	1 T	0.2 H	-	-	-	-	-	-	-
17 Heptachlor	-	-	-	-	-	-	-	117,000 L	5,850 P	5,290 T	-	-	-	-	-	-	-	-
22 Antimony	-	-	-	-	-	-	-	9,000 L	1,600 L	146 T	-	-	-	-	-	-	-	-
23 Arsenic	83	0.0166	0.0100	0.0020	0.03	100	-	360 C	190 C	0.0022 C	50 H	0.0	NA	0.0	0.0	0.9	0.0	0.3
25 Beryllium	3	0.0006	NA	-	0.00	-	-	130 L	5.3 L	0.0068 C	-	NA	-	-	-	-	-	0.0
26 Cadmium	-	-	-	-	-	20	20	3.9 C	1.1 C	10 T	10 H	-	-	-	-	-	-	-
27 Chromium	110	0.0217	0.0092	0.0010	0.10	10,000	1,000	1,700 C	210 C	170,000 T	50 H	0.0	0.0	0.0	0.0	0.0	0.0	0.4
29 Copper	320	0.0632	0.0114	0.0023	0.31	640	1,000	18 C	12 C	-	1,300 MAN	0.0	0.0	0.0	0.0	NA	0.0	1.1
31 Cyanide	-	-	-	-	-	100	-	22 C	5.2 C	200 T	-	-	-	-	-	-	-	-
32 Lead	53	0.0105	0.0031	0.0006	0.06	100	1,000	83 C	3.2 C	50 T	50 H	0.0	0.0	0.0	0.0	0.0	0.0	0.2
33 Mercury	-	-	-	-	-	103	10	2.4 C	0.012 C	0.144 T	2 H	-	-	-	-	-	-	-
34 Nickel	110	0.0217	0.0146	0.0029	0.29	250	200	1,400 C	160 C	13.4 T	-	0.0	0.0	0.0	0.0	0.0	NA	0.4
36 Silver	-	-	-	-	-	5,000	-	4.1 C	0.12 L	50 T	50 H	-	-	-	-	-	-	-
38 Zinc	3600	0.6715	0.1477	0.0294	3.12	30	2,000	120 C	110 C	-	5,000 SW	0.0	0.0	0.0	0.0	NA	0.0	11.3
46 Chloronaphthalene, 2-	8120	1.5036	0.0002	0.0160	3.15	-	-	1,600 L	16 P	-	-	NA	NA	0.0	0.0	NA	NA	27.1
49 Dichloroethane	-	-	-	-	-	100,000	-	193,000 L	9,650 P	0.19 C	-	-	-	-	-	-	-	-
50 Dichloroethane, 1,1-	-	-	-	-	-	1,000	-	55,000 L	2,750 P	3,000 PT	-	-	-	-	-	-	-	-
60 Trichloroethane, 1,1,1-	-	-	-	-	-	1,000	-	40,000 L	2,000 P	18,400 T	200 H	-	-	-	-	-	-	-
67 Trichloroethene	-	-	-	-	-	20,000	-	18,000 L	2,200 L	2.7 C	5 H	-	-	-	-	-	-	-
68 Tetrachloroethene	-	-	-	-	-	20,000	-	5,280 L	840 L	0.80 C	-	-	-	-	-	-	-	-
87 Ethylbenzene	-	-	-	-	-	-	-	12,100 L	6,800 L	1,400 T	680 MAN	-	-	-	-	-	-	-
89 Toluene	-	-	-	-	-	-	-	13,000 L	630 P	14,300 T	2,000 MAN	-	-	-	-	-	-	-
92 Phenol	-	-	-	-	-	200,000	-	8,950 L	750 L	3,500 T	-	-	-	-	-	-	-	-
122 Naphthalene	8053	1.5904	0.1590	0.0317	3.26	500,000	-	2,300 L	620 L	6,800 PT	-	0.0	NA	0.0	0.0	0.0	NA	26.9
126 Benzidine	-	-	-	-	-	5,000	-	2,500 L	125 P	0.00012 C	-	-	-	-	-	-	-	-
135 Ammonia	25	0.0049	NA	-	NA	-	-	8,467 C	1,151 C	-	-	NA	-	-	-	-	-	0.1
137 Phosphorus	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	-
138 Iron	140000	27.6489	NA	-	NA	-	-	-	1,000 C	-	300 SW	NA	-	-	-	-	-	467.0
139 Manganese	230000	45.4231	NA	-	NA	-	-	950 C	150 C	-	-	NA	-	-	-	-	-	767.3
140 Sulfide	1.4	0.0003	NA	-	NA	-	-	-	2 C	-	-	NA	-	-	-	-	-	0.0
142 Aluminum	9100	1.7972	NA	-	NA	-	-	-	300 L	-	50 SW	NA	-	-	-	-	-	30.4
143 Barium	2300	0.4542	0.0454	0.0090	2.44	-	-	410,000 L	2,013 L	-	1,000 H	NA	NA	0.0	0.0	NA	0.0	7.7
144 Cobalt	31	0.0061	NA	-	NA	-	-	1,620 L	38.2 L	-	-	NA	-	-	-	-	-	0.1
145 Fluoride	-	-	-	-	-	-	-	1,600 L	-	-	4,000 SW	-	-	-	-	-	-	-
146 Tin	250	0.0494	NA	-	NA	-	-	-	18.6 L	-	-	NA	-	-	-	-	-	0.0
147 Magnesium	31000	6.1222	NA	-	NA	-	-	-	367,600 L	-	-	NA	-	-	-	-	-	103.4
149 Titanium	8900	1.7577	NA	-	NA	-	-	-	191 L	-	-	NA	-	-	-	-	-	29.7
151 Molybdenum	15	0.0030	NA	-	NA	-	-	-	27.0 L	-	-	NA	-	-	-	-	-	0.1
154 Vanadium	190	0.0375	NA	-	NA	-	-	11,200 L	9 L	-	-	NA	-	-	-	-	-	0.6
156 Zirconium	-	-	-	-	-	-	-	-	10.3 L	-	-	-	-	-	-	-	-	-
160 Lithium	-	-	-	-	-	-	-	-	464 L	-	-	-	-	-	-	-	-	-
Boronol	-	-	-	-	-	-	-	90,000 L	500 P	99,900 PT	-	-	-	-	-	-	-	-
Boron	87	0.0172	NA	-	NA	-	-	-	31.6 L	-	-	NA	-	-	-	-	-	0.2
Decane, n-	12069	2.3835	NA	-	NA	-	-	18,000 L	1,300 L	-	-	NA	-	-	-	-	-	60.3

ENVIRONMENTAL ANALYSIS FOR THE PAINT FORMULATING INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: NAD
LOW STREAM FLOW

PLANT FLOW (MGD): 0.0016
STREAM FLOW (MGD): 32.6

POTW FLOW (MGD): 0.1
PLANT NO.: 8

POLLUTANT NAME	CONCENTRATIONS (UG/L)					CRITERIA (UG/L)						CONCENTRATION/CRITERIA						POLLUTANT LOADING (LB/YR)
	DISCH	POTWINF	POTWEFF	DPOTWEFF	(SLUDGE)	INH	SLUDGE	ACUTE	CHRONIC	HH-WHO	BHH	INH	SLUDGE	ACUTE	CHRONIC	HH-WHO	BHH	
Diphenylamine	15330	3.0291	0.3029	0.6603	1.30	-	-	-	-	934 PT	-	NA	NA	NA	NA	0.0	NA	51.2
Dodecane, n-	7642	1.5092	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	25.5
Eicosane, n-	3857	0.7617	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	12.9
Lanthanum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl ethyl ketone	-	-	-	-	-	-	-	520,000 L	70,000 L	1,500 PT	-	-	-	-	-	-	-	-
Nondyl-ion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octacosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octadecane, n-	4621	0.9126	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	15.4
Osmium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	-
Potassium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	23,000 L	6,800 L	-	140 PPM	-	-	-	-	-	-	-
Sulfur	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terpineol, alpha-	1028	0.2030	NA	-	NA	-	-	10,000 L	-	-	-	NA	-	-	-	-	-	3.4
Tetracosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yttrium	25	0.0049	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	0.1

ENVIRONMENTAL ANALYSIS FOR THE PRIMARY CONVERSION INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: [illegible]
LOW SIMILAR FLOW

PLANT FLOW (MGD): 0.001
SIMILAR FLOW (MGD): 37.6

POTW FLOW (MGD): 0.1
PLANT NO.: 9

POLLUTANT NAME	CONCENTRATIONS (UG/L)					CRITERIA (UG/L)						CONCENTRATION/CRITERIA						POLLUTANT LOADING (LB/YR)
	RECEIVED	PLANT	POTW EFF	POTW EFF	SLUDGE	FWA	SLUDGE	ACUTE	CHRONIC	NON-HUM	HUM	FWA	SLUDGE	ACUTE	CHRONIC	NON-HUM	HUM	
10 BHC	-	-	-	-	-	-	-	1.1 C	0.001 C	0.000024 C	-	-	-	-	-	-	-	-
14 Endosulfan sulfate	-	-	-	-	-	-	-	0.22 C	0.056 C	74 T	-	-	-	-	-	-	-	-
15 Endrin	-	-	-	-	-	-	-	0.18 C	0.0023 C	1 T	0.2 H	-	-	-	-	-	-	-
19 Isophorone	3090	0.3816	NA	-	NA	-	-	117,000 L	5,850 W	5,200 T	-	NA	-	-	-	-	-	6.4
22 Aldrin	-	-	-	-	-	-	-	9,000 L	1,600 L	146 T	-	-	-	-	-	-	-	-
23 Arsenic	-	-	-	-	-	100	-	360 C	190 C	0.0022 C	50 H	-	-	-	-	-	-	-
25 Beryllium	-	-	-	-	-	-	-	130 L	5.3 L	0.0068 C	-	-	-	-	-	-	-	-
26 Cadmium	217	0.0268	0.0104	0.0021	0.10	20	20	3.9 C	1.1 C	10 T	10 H	0.0	0.0	0.0	0.0	0.0	0.0	0.5
27 Chromium	822	0.1015	0.0244	0.0049	0.46	10,000	1,000	1,700 C	210 C	170,000 T	50 H	0.0	0.0	0.0	0.0	0.0	0.0	1.7
30 Copper	313	0.0386	0.0070	0.0014	0.39	480	1,000	18 C	12 C	-	1,300 PWS	0.0	0.0	0.0	0.0	NA	0.0	0.7
31 Cyanide	0.11	0.0000	0.0000	0.0000	0.00	100	-	22 C	5.2 C	200 T	-	0.0	NA	0.0	0.0	0.0	NA	0.0
32 Lead	1830	0.2259	0.0678	0.0135	0.59	100	1,000	83 C	3.2 C	50 T	50 H	0.0	0.0	0.0	0.0	0.0	0.0	3.8
33 Mercury	3500	0.4320	0.1720	0.0344	1.20	100	10	2.4 C	0.012 C	0.144 T	2 H	0.0	0.1	0.1	2.9 *	0.2	0.0	7.3
34 Nickel	-	-	-	-	-	250	200	1,400 C	160 C	13.4 T	-	-	-	-	-	-	-	-
35 Silver	-	-	-	-	-	5,000	-	4.1 C	0.12 L	50 T	50 H	-	-	-	-	-	-	-
38 Zinc	843000	104.0612	22.8935	0.5606	483.95	50	2,000	120 C	110 C	-	5,000 SW	3.5 *	0.2	0.2	0.0	NA	0.0	1,757.7
46 Chloronaphthalene, 2-	-	-	-	-	-	-	-	1,600 L	16 W	-	-	-	-	-	-	-	-	-
47 Dichloroethane	-	-	-	-	-	100,000	-	193,000 L	9,650 W	0.19 C	-	-	-	-	-	-	-	-
50 Dichloroethene, 1,1-	-	-	-	-	-	1,000	-	55,000 L	2,750 W	3,000 GW	-	-	-	-	-	-	-	-
60 Trichloroethane, 1,1,1-	1044	0.1282	0.0160	0.0032	0.30	1,000	-	40,000 L	2,000 W	18,400 T	200 H	0.0	NA	0.0	0.0	0.0	0.0	3.0
67 Trichloroethene	372	0.0460	0.0073	0.0015	0.05	20,000	-	18,000 L	2,200 L	2.7 C	5 H	0.0	NA	0.0	0.0	0.0	0.0	0.8
68 Tetrachloroethene	1092	0.1348	0.0125	0.0027	0.16	20,000	-	5,280 L	840 L	0.80 C	-	0.0	NA	0.0	0.0	0.0	NA	2.3
87 Ethylbenzene	119186	14.7125	0.7376	0.1465	16.03	-	-	12,100 L	6,800 L	1,400 T	680 PWS	NA	NA	0.0	0.0	0.0	0.0	248.5
89 Toluene	100793	12.4429	0.3733	0.0744	21.50	-	-	13,000 L	650 W	14,300 T	2,000 PWS	NA	NA	0.0	0.0	0.0	0.0	210.2
92 Phenol	-	-	-	-	-	200,000	-	8,900 L	750 L	3,500 T	-	-	-	-	-	-	-	-
122 Naphthalene	4696	0.5797	0.0580	0.0115	0.58	500,000	-	2,300 L	620 L	6,800 GW	-	0.0	NA	0.0	0.0	0.0	NA	9.0
128 Benzidine	-	-	-	-	-	5,000	-	2,500 L	125 W	0.00012 C	-	-	-	-	-	-	-	-
135 Aluminum	65	0.0078	NA	-	NA	-	-	8,447 C	1,151 C	-	-	NA	-	-	-	-	-	0.1
137 Phosphorus	7	0.0009	NA	-	NA	-	-	2 L	-	-	-	NA	-	-	-	-	-	0.0
138 Iron	14400	1.7776	NA	-	NA	-	-	-	1,000 C	-	300 SW	NA	-	-	-	-	-	30.0
139 Aluminum	135000	16.6646	NA	-	NA	-	-	950 C	150 C	-	-	NA	-	-	-	-	-	281.5
140 Sulfide	-	-	-	-	-	-	-	-	2 C	-	-	-	-	-	-	-	-	-
142 Manganese	795	0.0981	NA	-	NA	-	-	-	300 L	-	50 SW	NA	-	-	-	-	-	1.7
143 Barium	3780	0.4666	0.0467	0.0093	2.50	-	-	410,000 L	2,813 L	-	1,000 H	NA	NA	0.0	0.0	NA	0.0	7.9
144 Cobalt	1630	0.2061	NA	-	NA	-	-	1,620 L	38.2 L	-	-	NA	-	-	-	-	-	3.5
145 Fluoride	-	-	-	-	-	-	-	1,600 L	-	-	4,000 SW	-	-	-	-	-	-	-
146 Tin	481	0.0590	NA	-	NA	-	-	-	18.6 L	-	-	NA	-	-	-	-	-	1.0
147 Magnesium	21800	2.6910	NA	-	NA	-	-	-	367,600 L	-	-	NA	-	-	-	-	-	45.5
149 Titanium	2970	0.3666	NA	-	NA	-	-	-	191 L	-	-	NA	-	-	-	-	-	6.2
151 Molybdenum	-	-	-	-	-	-	-	-	27.8 L	-	-	-	-	-	-	-	-	-
154 Vanadium	74	0.0091	NA	-	NA	-	-	11,200 L	9 L	-	-	NA	-	-	-	-	-	0.2
156 Zirconium	0.3	0.0000	NA	-	NA	-	-	-	10.3 L	-	-	NA	-	-	-	-	-	0.0
160 Lithium	0.1	0.0000	NA	-	NA	-	-	-	464 L	-	-	NA	-	-	-	-	-	0.0
Boron	1926380	237.7953	11.8898	2.3585	139.04	-	-	10,000 L	500 W	99,900 GW	-	NA	NA	0.0	0.0	0.0	NA	4,016.5
Boron	1400	0.1728	NA	-	NA	-	-	-	31.6 L	-	-	NA	-	-	-	-	-	2.9
Boron, w-	-	-	-	-	-	-	-	18,000 L	1,300 L	-	-	-	-	-	-	-	-	-

ENVIRONMENTAL ANALYSIS FOR THE PAINT FORMULATING INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: [illegible] PLANT FLOW (MGD): 0.001 POTW FLOW (MGD): 0.1
LOW STREAM FLOW STREAM FLOW (MGD): 32.6 PLANT NO.: 0

POLLUTANT NAME	CONCENTRATIONS (UG/L)					CRITERIA (UG/L)						CONCENTRATION/CRITERIA						POLLUTANT LOADING (LB/YR)
	DISCH	POTWINF	POTWEFF	BPOTWEFF	(SLUDGE)	INH	SLUDGE	ACUTE	CHRONIC	HH-WHO	DWS	INH	SLUDGE	ACUTE	CHRONIC	HH-WHO	DWS	
Diphenylamine	-	-	-	-	-	-	-	-	-	934 PT	-	-	-	-	-	-	-	-
Dodecane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eicosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lanthanum	0.1	0.0000	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	0.0
Methyl ethyl ketone	-	-	-	-	-	-	-	520,000 L	70,000 L	1,500 PT	-	-	-	-	-	-	-	-
Neodymium	0.5	0.0001	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	0.0
Octacosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octadecane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Osmium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	-
Potassium	5	0.0006	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	0.0
Strontium	0	0.0005	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	0.0
Styrene	-	-	-	-	-	-	-	23,000 L	6,800 L	-	100 PPM	-	-	-	-	-	-	-
Sulfur	126	0.0156	NA	-	NA	-	-	-	-	-	-	NA	-	-	-	-	-	0.3
Terpineol, alpha-	-	-	-	-	-	-	-	10,000 L	-	-	-	-	-	-	-	-	-	-
Tetracosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yttrium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[illegible] ANALYSIS FOR THE POINT GENERATING INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: [illegible]
LOW STATION FLOW

PLANT FLOW (MGD): 0.002
STATION FLOW (MGD): 32.6

POTW FLOW (MGD): 0.1
PLANT NO.: E

POLLUTANT NAME	CONCENTRATIONS (UG/L)					CRITERIA (UG/L)						CONCENTRATION/CRITERIA						POLLUTANT LOADING (LB/YR)
	BISON	POTOMAC	POTBETT	BROMBETT	TELEDYNE	FWA	BLIDRE	ACUTE	CHRONIC	HH-WQO	DWS	FWA	BLIDRE	ACUTE	CHRONIC	HH-WQO	DWS	
10 DDT	2	0.0005	NA	-	NA	-	-	1.1 C	0.001 C	0.000024 C	-	NA	-	-	-	-	-	0.0
14 Endosulfan sulfate	1130	0.2789	NA	-	NA	-	-	0.22 C	0.056 C	74 T	-	NA	-	-	-	-	-	0.7
15 Endrin	110	0.0272	0.0014	0.0003	0.06	-	-	0.18 C	0.0023 C	1 T	0.2 H	NA	NA	0.0	0.1	0.0	0.0	0.5
17 Isophorone	-	-	-	-	-	-	-	117,000 L	5,850 O	5,200 T	-	-	-	-	-	-	-	-
22 Antimony	-	-	-	-	-	-	-	9,000 L	1,600 L	146 T	-	-	-	-	-	-	-	-
23 Arsenic	58	0.0143	0.0007	0.0017	0.00	100	-	360 C	190 C	0.0022 C	50 H	0.0	NA	0.0	0.0	0.0	0.0	0.2
25 Beryllium	-	-	-	-	-	-	-	130 L	5.3 L	0.0068 C	-	-	-	-	-	-	-	-
26 Cadmium	30	0.0074	0.0029	0.0006	0.02	20	20	3.9 C	1.1 C	10 T	10 H	0.0	0.0	0.0	0.0	0.0	0.0	0.1
29 Chromium	4620	1.1405	0.2737	0.0545	5.17	10,000	1,000	1,700 C	210 C	170,000 T	50 H	0.0	0.0	0.0	0.0	0.0	0.0	19.3
30 Copper	58	0.0143	0.0006	0.0005	0.07	400	1,000	18 C	12 C	-	1,300 MAR	0.0	0.0	0.0	0.0	NA	0.0	0.2
31 Cyanide	-	-	-	-	-	100	-	22 C	5.2 C	200 T	-	-	-	-	-	-	-	-
32 Lead	122	0.0301	0.0090	0.0010	0.15	100	1,000	83 C	3.2 C	50 T	50 H	0.0	0.0	0.0	0.0	0.0	0.0	0.5
33 Mercury	-	-	-	-	-	100	10	2.4 C	0.012 C	0.144 T	2 H	-	-	-	-	-	-	-
34 Nickel	44	0.0109	0.0073	0.0014	0.05	250	200	1,400 C	160 C	13.4 T	-	0.0	0.0	0.0	0.0	0.0	NA	0.2
36 Silver	-	-	-	-	-	5,000	-	4.1 C	0.12 L	50 T	50 H	-	-	-	-	-	-	-
38 Zinc	3390	0.0838	0.1041	0.0367	3.09	30	2,000	120 C	110 C	-	5,000 SW	0.0	0.0	0.0	0.0	NA	0.0	14.1
46 Chloroethylene, 2-	-	-	-	-	-	-	-	1,600 L	16 O	-	-	-	-	-	-	-	-	-
47 Dichloromethane	481612	118.8872	5.9444	1.1842	67.31	100,000	-	193,000 L	9,650 O	0.19 C	-	0.0	NA	0.0	0.0	6.2 H	NA	2,008.3
48 Dichloroethane, 1,1-	-	-	-	-	-	1,000	-	55,000 L	2,750 O	3,800 OT	-	-	-	-	-	-	-	-
60 Trichloroethane, 1,1,1-	-	-	-	-	-	1,000	-	60,000 L	2,000 O	18,400 T	200 H	-	-	-	-	-	-	-
67 Trichloroethene	-	-	-	-	-	20,000	-	18,000 L	2,200 L	2.7 C	5 H	-	-	-	-	-	-	-
68 Tetrachloroethene	-	-	-	-	-	20,000	-	5,280 L	840 L	0.80 C	-	-	-	-	-	-	-	-
87 Ethylbenzene	2183	0.5389	0.0065	0.0054	0.61	-	-	12,100 L	6,800 L	1,400 T	680 MAR	NA	NA	0.0	0.0	0.0	0.0	9.1
89 Toluene	621	0.1533	0.0046	0.0009	0.27	-	-	13,000 L	650 O	14,300 T	2,000 MAR	NA	NA	0.0	0.0	0.0	0.0	2.6
92 Phenol	1010	0.4440	0.0090	0.0018	0.26	200,000	-	8,900 L	750 L	3,500 T	-	0.0	NA	0.0	0.0	0.0	NA	7.6
122 Naphthalene	-	-	-	-	-	300,000	-	2,300 L	620 L	6,800 OT	-	-	-	-	-	-	-	-
128 Benzidine	-	-	-	-	-	5,000	-	2,500 L	125 O	0.00012 C	-	-	-	-	-	-	-	-
135 Aniline	61	0.0151	NA	-	NA	-	-	8,467 C	1,151 C	-	-	NA	-	-	-	-	-	0.3
137 Phosphorus	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	-
138 Iron	104000	25.6727	NA	-	NA	-	-	-	1,000 C	-	300 SW	NA	-	-	-	-	-	633.7
139 Aluminum	840	0.2074	NA	-	NA	-	-	950 C	150 C	-	-	NA	-	-	-	-	-	1.5
140 Sulfide	-	-	-	-	-	-	-	-	2 C	-	-	-	-	-	-	-	-	-
142 Manganese	1100	0.2715	NA	-	NA	-	-	-	300 L	-	50 SW	NA	-	-	-	-	-	0.6
143 Boron	1260	0.3110	0.0311	0.0052	1.67	-	-	410,000 L	2,013 L	-	1,000 H	NA	NA	0.0	0.0	NA	0.0	5.3
144 Cobalt	330	0.0814	NA	-	NA	-	-	1,620 L	38.2 L	-	-	NA	-	-	-	-	-	1.4
145 Fluoride	0.5	0.0001	NA	-	NA	-	-	1,600 L	-	-	4,000 SW	NA	-	-	-	-	-	0.0
146 Tin	-	-	-	-	-	-	-	-	18.6 L	-	-	-	-	-	-	-	-	-
147 Magnesium	26000	6.4182	NA	-	NA	-	-	-	367,600 L	-	-	NA	-	-	-	-	-	108.0
149 Titanium	36	0.0089	NA	-	NA	-	-	-	191 L	-	-	NA	-	-	-	-	-	0.2
151 Molybdenum	-	-	-	-	-	-	-	-	27.8 L	-	-	-	-	-	-	-	-	-
154 Vanadium	-	-	-	-	-	-	-	11,200 L	9 L	-	-	-	-	-	-	-	-	-
156 Zirconium	-	-	-	-	-	-	-	-	10.3 L	-	-	-	-	-	-	-	-	-
160 Lithium	-	-	-	-	-	-	-	-	464 L	-	-	-	-	-	-	-	-	-
Aluminum	4576	1.1296	0.0965	0.0113	0.64	-	-	10,000 L	500 O	99,900 OT	-	NA	NA	0.0	0.0	0.0	NA	19.1
Boron	210	0.0518	NA	-	NA	-	-	-	31.6 L	-	-	NA	-	-	-	-	-	0.9
Bromo, D-	-	-	-	-	-	-	-	18,000 L	1,300 L	-	-	-	-	-	-	-	-	-

ENVIRONMENTAL ANALYSIS FOR THE PAINT FORMULATING INDUSTRY
INDIRECT DISCHARGERS

TREATMENT LEVEL: RAW
LOW STREAM FLOW

PLANT FLOW (MGD): 0.002
STREAM FLOW (MGD): 32.6

POTW FLOW (MGD): 0.1
PLANT NO.: E

POLLUTANT NAME	CONCENTRATIONS (UG/L)					CRITERIA (UG/L)						CONCENTRATION/CRITERIA						POLLUTANT LOADING (LB/YR)
	DISCH	POTWINF	POTWEFF	DPOTWEFF	(SLUDGE)	INH	SLUDGE	ACUTE	CHRONIC	HH-WQO	DWS	INH	SLUDGE	ACUTE	CHRONIC	HH-WQO	DWS	
Biphenylamine	-	-	-	-	-	-	-	-	-	934 PT	-	-	-	-	-	-	-	-
Dodecane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eicosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lanthanum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl ethyl ketone	119736	29.5571	1.4779	0.2999	16.74	-	-	520,000 L	70,000 L	1,300 PT	-	NA	NA	0.0	0.0	0.0	NA	499.3
Neodymium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octacosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octadecane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Osmium	170	0.0456	ND	-	ND	-	-	-	-	-	-	ND	-	-	-	-	-	0.7
Phenol	-	-	-	-	-	-	-	2 L	-	-	-	-	-	-	-	-	-	-
Potassium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	13300	3.2631	ND	-	ND	-	-	-	-	-	-	ND	-	-	-	-	-	55.5
Styrene	2329	0.3709	ND	-	ND	-	-	23,000 L	6,800 L	-	140 PWR	ND	-	-	-	-	-	9.7
Sulfur	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terpineol, alpha-	-	-	-	-	-	-	-	10,000 L	-	-	-	-	-	-	-	-	-	-
Tetracosane, n-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yttrium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

APPENDIX F

DILUTION FACTOR RESULTS INDIRECTS

POTWCAT UNIT	REACH NUMBER	RIT FLAG	TOTAL PLANT FLOW (MGD)	BPLANTS FLOW >0	POTWFLOW (MGD)	B	RECEIVING STREAMFLOW AVGFLOW (MGD)	RECEIVING STREAMFLOW LOWFLOW (MGD)	SEWER DILUTION FACTOR	POTW RECEIVING STREAM DILUTION FACTOR AVERAGE	POTW RECEIVING STREAM DILUTION FACTOR 7-Q-10
18050004001		N	0.0488	2	8.100		-	-	165.98	-	-
18070104003		Y	0.0144	2	238.000		-	-	16527.78	-	-
7080104002		Y	0.0630	1	3.000	B	42251.89	10480.74	47.62	14083.96	3493.58
7090005014		Y	0.0545	1	44.900	B	2428.46	597.99	823.85	54.09	13.32
7120003006		N	0.0800	1	10.400	B	203.89	40.20	130.00	19.60	3.87
7120004009		Y	1.3800	7	797.000	B	960.75	308.97	574.21	1.21	1.39
7120003007		Y	5.5160	2	192.000	B	145.47	47.22	34.81	1.76	1.25
4040002001		N	0.1760	1	335.000		-	-	1903.41	-	-
4040002002		Y	0.3240	1	18.800		-	-	58.02	-	-
4100005005		Y	0.0260	1	36.200	B	1094.16	39.72	1392.31	30.23	1.10
8090301040		N	0.1460	1	3.600		-	-	24.66	-	-
B		U	0.0002	1	0.026		-	-	129.00	-	-
2060003025		N	0.1270	1	185.730		-	-	1462.44	-	-
4090003006		Y	0.1400	1	5.450	B	161.06	28.32	38.93	29.55	5.20
7010206002		[illegible]	0.4220	3	206.000	B	6915.64	933.04	488.15	33.57	4.53
7140101019		Y	0.3510	1	150.000	B	114411.75	21525.58	427.35	762.74	143.50
10300101030		Y	0.3066	2	3.000	B	31077.07	3243.08	9.78	10359.02	1081.03
2030104005		Y	0.0125	1	86.400		-	-	6912.00	-	-
2030104002		N	0.0075	1	20.000		-	-	2666.67	-	-
2030104001		Y	0.0108	1	260.000		-	-	24163.59	-	-
2030104002		N	0.2720	2	0.015		-	-	1.06	-	-
2040202030		Y	0.3000	2	2.720		-	-	9.07	-	-
2030101007		Y	0.0070	1	34.900		-	-	4985.71	-	-
2030201004		Y	0.0013	1	6.700		-	-	5153.85	-	-
4140201057		Y	0.0048	2	50.000	C	-	-	10373.45	-	-
4110002001		Y	0.7050	4	94.000	B	875.78	47.02	133.33	6.13	1.50
5060001027		N	0.1144	2	91.700	B	934.74	50.99	801.57	10.19	1.56
11070107021		N	0.0070	1	6.200	B	10.43	0.07	885.71	1.68	1.01
17090003063		Y	0.0036	1	25.000	B	3650.77	389.29	6944.45	146.03	15.57
2040203010		Y	0.1080	1	10.100	B	1215.57	58.98	93.52	120.35	5.84
5130202006		Y	0.0109	1	50.100	B	13743.19	571.73	4596.33	274.31	11.41
12030102009		Y	0.0290	1	44.200	B	794.77	2.94	1524.14	17.98	1.07
12030106052		Y	0.1010	1	15.700	B	7.47	0.06	155.45	1.48	1.00
12030105022		Y	0.0376	1	134.000	B	1371.29	3.57	3563.83	10.23	1.03
3010101033		Y	0.0240	1	23.600	B	199.66	32.56	983.33	8.46	1.38
17010307021		Y	0.0090	1	35.000	B	4550.50	571.95	3888.89	130.01	16.34
17110019006		Y	0.0124	2	195.000		-	-	15725.81	-	-
17110013005		Y	0.0009	1	37.500	B	988.88	155.23	41666.67	26.37	4.14
17110014001		Y	0.0073	1	23.400	B	2189.62	527.02	3205.48	93.57	22.52

TOTAL INDIRECT DISCHARGE FLOW(MGD)
WITHIN EACH U.S.G.S. MAJOR BASIN
FOR SIC CODES
2851

U.S.G.S MAJOR BASIN	TOTAL PLANTFLOW	TOTAL # OF PLANTS	TOTAL POTWFLOW	TOTAL # OF POTWS	TOTAL % PLANTFLOW	TOTAL % PLANTS	TOTAL %POTWFLOW	TOTAL % POTWS
1	0.000	0	0.000	0	0.000	0.000	0.000	0.000
2	0.046	12	606.564	9	7.713	19.355	17.413	23.684
3	0.024	1	23.600	1	0.219	1.613	0.677	2.632
4	1.376	9	539.450	6	12.542	14.516	15.486	15.789
5	0.125	3	141.800	2	1.142	4.839	4.071	5.263
6	0.000	0	0.000	0	0.000	0.000	0.000	0.000
7	7.874	26	1403.300	7	71.787	25.806	40.285	18.421
8	0.146	1	3.600	1	1.331	1.613	0.103	2.632
9	0.000	0	0.000	0	0.000	0.000	0.000	0.000
10	0.307	2	3.000	1	2.795	3.226	0.086	2.632
11	0.007	1	6.200	1	0.064	1.613	0.178	2.632
12	0.168	7	193.900	3	1.528	11.290	5.566	7.895
13	0.000	0	0.000	0	0.000	0.000	0.000	0.000
14	0.000	0	0.000	0	0.000	0.000	0.000	0.000
15	0.000	0	0.000	0	0.000	0.000	0.000	0.000
16	0.000	0	0.000	0	0.000	0.000	0.000	0.000
17	0.033	6	315.900	5	0.303	9.677	9.069	13.158
18	0.063	4	246.100	2	0.576	6.452	7.065	5.263
TOTAL	10.969	62.000	3483.413	38.000				

INDIRECT DISCHARGE DILUTION FACTOR
(ON AND OFF REACH)
DISTRIBUTION FOR SIC CODES

2851

PERCENTILE	SEWER DILUTION FACTOR		POTW RECEIVING STREAM DILUTION FACTOR AVERAGE STREAM FLOW		7 - Q - 10 FLOW	
5	2 /	9.067	2 /	1.476	2 /	1.011
10	4 /	24.658	3 /	1.683	3 /	1.027
15	6 /	38.929	4 /	1.758	4 /	1.067
20	8 /	58.025	5 /	6.125	5 /	1.097
25	10 /	129.000	6 /	8.460	6 /	1.246
30	12 /	133.333	7 /	10.193	7 /	1.380
35	14 /	165.904	8 /	10.234	8 /	1.388
40	16 /	488.152	9 /	17.981	9 /	1.500
45	18 /	801.573	10 /	19.604	10 /	1.556
50	20 /	885.714	12 /	29.552	12 /	4.139
55	21 /	963.333	13 /	30.225	13 /	4.929
60	23 /	1462.441	14 /	35.571	14 /	5.197
65	25 /	1903.409	15 /	54.886	15 /	8.039
70	27 /	3205.488	16 /	93.574	16 /	11.412
75	29 /	3888.889	17 /	120.354	17 /	13.310
80	31 /	4985.711	18 /	130.014	18 /	15.572
85	33 /	6911.996	19 /	146.031	19 /	16.342
90	35 /	10373.449	20 /	274.315	20 /	22.522
95	37 /	18527.777	21 /	762.745	21 /	143.504
MAXIMUM	39 /	81666.672	23 /	14883.965	23 /	3493.581

INDIRECT DISCHARGE DILUTION FACTOR
(ON REACH)
DISTRIBUTION FOR SIC CODES

2851

PERCENTILE	SEWER DILUTION FACTOR		POTW RECEIVING STREAM DILUTION FACTOR AVERAGE STREAM FLOW		7 - Q - 10 FLOW	
5	2 /	9.785	1 /	1.205	1 /	1.004
10	3 /	24.888	2 /	1.476	2 /	1.027
15	5 /	47.619	3 /	1.758	3 /	1.067
20	6 /	58.825	4 /	6.125	4 /	1.097
25	8 /	133.333	5 /	8.460	5 /	1.246
30	9 /	185.446	6 /	10.234	6 /	1.300
35	10 /	427.350	7 /	17.981	7 /	1.368
40	12 /	574.200	8 /	26.370	8 /	1.500
45	13 /	823.853	9 /	29.552	9 /	4.139
50	15 /	1392.308	10 /	30.225	10 /	4.529
55	16 /	2324.136	11 /	33.571	11 /	5.197
60	17 /	3235.480	12 /	54.086	12 /	5.839
65	19 /	3868.889	13 /	93.574	13 /	11.412
70	20 /	4596.320	14 /	120.354	14 /	13.318
75	22 /	5153.848	15 /	130.814	15 /	15.572
80	23 /	6911.996	16 /	146.831	16 /	16.342
85	24 /	6944.445	17 /	274.315	17 /	22.522
90	26 /	15725.809	18 /	762.745	18 /	143.504
95	27 /	26527.777	19 /	10359.020	19 /	1081.020
MAXIMUM	29 /	41666.672	20 /	14083.965	20 /	3495.581

DISTRIBUTION FREQUENCIES (MGD)- INDIRECT DISCHARGERS
(ON AND OFF REACH)

PERCENTILE	PLANTFLOW		POTWFLOW		RECEIVING STREAM FLOWS AVERAGE FLOW		7 - Q - 10 FLOW	
5	2 /	0.001	2 /	0.026	2 /	10.432	2 /	0.069
10	4 /	0.004	4 /	3.000	3 /	145.465	3 /	2.940
15	6 /	0.007	6 /	3.600	4 /	161.060	4 /	3.570
20	8 /	0.007	8 /	6.200	5 /	199.662	5 /	28.323
25	10 /	0.009	10 /	8.100	6 /	203.889	6 /	32.561
30	12 /	0.011	12 /	10.400	7 /	579.753	7 /	39.721
35	14 /	0.012	14 /	18.800	8 /	794.772	8 /	40.201
40	16 /	0.024	16 /	23.400	9 /	934.740	9 /	47.816
45	18 /	0.029	18 /	25.000	10 /	960.750	10 /	47.217
50	20 /	0.045	20 /	35.000	12 /	1094.162	12 /	58.976
55	21 /	0.056	21 /	36.200	13 /	1215.974	13 /	155.226
60	23 /	0.060	23 /	44.200	14 /	1371.289	14 /	308.965
65	25 /	0.100	25 /	50.000	15 /	2189.625	15 /	389.291
70	27 /	0.127	27 /	86.400	16 /	2420.456	16 /	527.021
75	29 /	0.140	29 /	94.000	17 /	3650.769	17 /	571.728
80	31 /	0.272	31 /	150.000	18 /	4550.496	18 /	871.954
85	33 /	0.307	33 /	192.000	19 /	6915.641	19 /	897.989
90	35 /	0.358	35 /	206.000	20 /	13745.168	20 /	933.037
95	37 /	0.705	37 /	260.000	21 /	31077.066	21 /	3243.004
MAXIMUM	39 /	5.510	39 /	797.000	23 /	114411.750	23 /	21525.582

DISTRIBUTION FREQUENCIES(MGD)- INDIRECT DISCHARGERS
(ON REACH)

PERCENTILE	PLANTFLOW		POTWFLOW		RECEIVING STREAM FLOWS AVERAGE FLOW		7 - Q - 10 FLOW	
5	2 /	0.001	2 /	3.000	1 /	7.467	1 /	0.057
10	3 /	0.004	3 /	3.000	2 /	145.465	2 /	2.940
15	5 /	0.007	5 /	6.700	3 /	161.060	3 /	3.570
20	6 /	0.007	6 /	10.100	4 /	199.662	4 /	20.323
25	8 /	0.011	8 /	18.000	5 /	575.753	5 /	32.561
30	9 /	0.011	9 /	23.400	6 /	794.772	6 /	39.721
35	10 /	0.012	10 /	23.600	7 /	960.750	7 /	47.016
40	12 /	0.014	12 /	34.900	8 /	988.079	8 /	47.217
45	13 /	0.024	13 /	35.000	9 /	1094.162	9 /	58.976
50	15 /	0.029	15 /	37.500	10 /	1215.574	10 /	159.226
55	16 /	0.036	16 /	44.200	11 /	1371.289	11 /	300.965
60	17 /	0.054	17 /	44.900	12 /	2189.625	12 /	389.291
65	19 /	0.101	19 /	50.100	13 /	2420.456	13 /	527.021
70	20 /	0.108	20 /	86.400	14 /	3650.769	14 /	571.720
75	22 /	0.300	22 /	134.000	15 /	4550.496	15 /	571.954
80	23 /	0.307	23 /	150.000	16 /	6915.641	16 /	597.909
85	24 /	0.324	24 /	192.000	17 /	13745.180	17 /	953.037
90	26 /	0.422	26 /	206.000	18 /	31077.066	18 /	3243.004
95	27 /	0.705	27 /	258.000	19 /	42251.095	19 /	10480.742
MAXIMUM	29 /	5.516	29 /	797.000	20 /	114411.750	20 /	21525.502